

AD-A051 704

ARINC RESEARCH CORP ANNAPOLIS MD
CATALOG OF TECHNIQUES SUPPORTING SHIP MAINTENANCE MANAGEMENT, (U)

F/G 13/10

JUN 76 N J SCARLETT

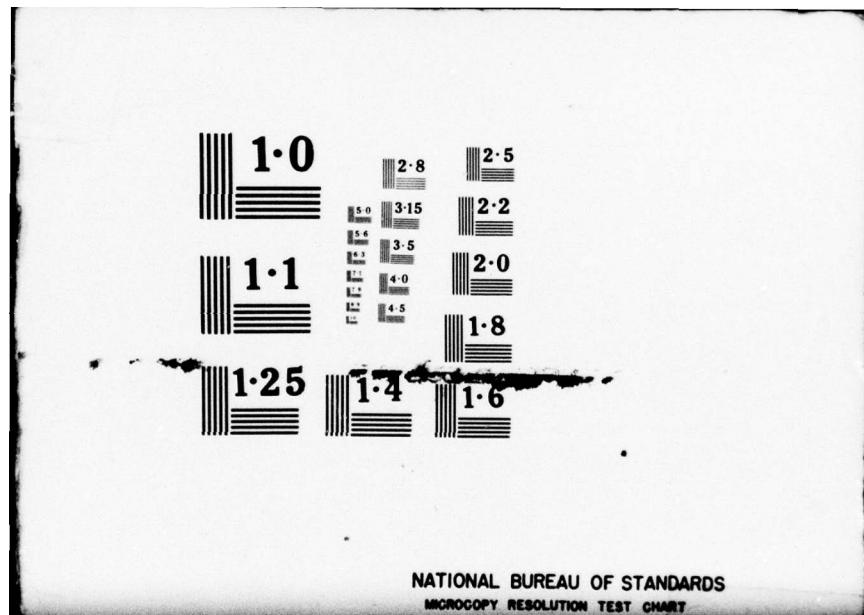
UNCLASSIFIED

626-32-4-1502

NL

1 OF 2
ADA
051704





NATIONAL BUREAU OF STANDARDS
MICROCOPY RESOLUTION TEST CHART

MKT

Publication 626-32-4-1502

(1)

CATALOG OF TECHNIQUES
SUPPORTING SHIP MAINTENANCE MANAGEMENT

June 1976

Prepared as an Internal
Research and Development Project
Work Order 0626-32



AD No.
1
ONE FILE COPY

ARINC RESEARCH CORPORATION

DISTRIBUTION STATEMENT A
Approved for public release;
Distribution Unlimited

UNCLASSIFIED

SECURITY CLASSIFICATION OF THIS PAGE (When Data Entered)

REPORT DOCUMENTATION PAGE		READ INSTRUCTIONS BEFORE COMPLETING FORM
1. REPORT NUMBER 626-32-4-1502	2. GOVT ACCESSION NO.	3. RECIPIENT'S CATALOG NUMBER
4. TITLE (and Subtitle) CATALOG OF TECHNIQUES SUPPORTING SHIP MAINTENANCE MANAGEMENT		5. TYPE OF REPORT & PERIOD COVERED
6. AUTHOR(s) Neil J. /Scarlett		7. PERFORMING ORG. REPORT NUMBER 626-32-4-1502
8. CONTRACTOR OR GRANT NUMBER(s)		No Contract No. Internal R&D Project
9. PERFORMING ORGANIZATION NAME AND ADDRESS ARINC Research Corp. 2551 Riva Road Annapolis, Maryland 21401		10. PROGRAM ELEMENT, PROJECT, TASK AREA & WORK UNIT NUMBERS
11. CONTROLLING OFFICE NAME AND ADDRESS 12 134 P.		12. REPORT DATE June 1976
13. MONITORING AGENCY NAME & ADDRESS(if different from Controlling Office)		14. NUMBER OF PAGES 90
15. SECURITY CLASS. (of this report) UNCLASSIFIED		15a. DECLASSIFICATION/DOWNGRADING SCHEDULE
16. DISTRIBUTION STATEMENT (of this Report) UNCLASSIFIED/UNLIMITED		
17. DISTRIBUTION STATEMENT (of the abstract entered in Block 20, if different from Report)		
18. SUPPLEMENTARY NOTES		
19. KEY WORDS (Continue on reverse side if necessary and identify by block number)		
20. ABSTRACT (Continue on reverse side if necessary and identify by block number) Techniques relating to the management of ship maintenance programs are catalogued on the basis of their characteristics and applications. Brief descriptions are given of each technique, together with references to other documents providing greater detail.		

400 247

48

(1)

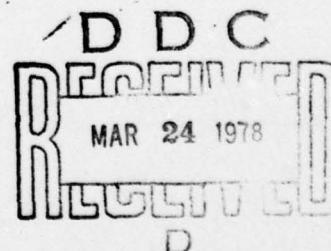
CATALOG OF TECHNIQUES
SUPPORTING SHIP MAINTENANCE MANAGEMENT

June 1976

Prepared as an Internal
Research and Development Project
Work Order 0626-32

Prepared by
Neil J. Scarlett

ACCESSION for	
RTIS	White Saffron <input checked="" type="checkbox"/>
DDG	Buff Saffron <input type="checkbox"/>
UNANNOUNCED	
JUSTIFICATION	
BY	
DISTRIBUTION/AVAILABILITY CODES	
BOL AVAIL. REG/IN SPECIAL	
A	



ARINC RESEARCH CORPORATION

CORPORATE HEADQUARTERS
2551 Riva Road
Annapolis, MD 21401

SAN DIEGO OFFICE
3565 Kenyon Street, Suite 7
San Diego, CA 92110

Publication 626-32-4-1502

DISTRIBUTION STATEMENT A
Approved for public release;
Distribution Unlimited

Copyright © 1976
ARINC Research Corporation

ABSTRACT

Techniques relating to the management of ship maintenance programs are cataloged on the basis of their characteristics and applications. Brief descriptions are given of each technique, together with references to other documents providing greater detail.

ABBREVIATIONS

AAW	- Antiair Warfare
APL	- Allowance Parts List
ASW	- Antisubmarine Warfare
CASREPT	- Casualty Report
CER	- Cost-Estimating Relationships
CID	- Component Identification (Number)
CINCPACFLT	- Commander-In-Chief, U.S. Pacific Fleet
CLMDP	- CAPTOR Logistics Management Data Program
COMSERVPAC	- Commander Service Force, Pacific
COSAL	- Coordinated Shipboard Allowance List
CPIC	- Coastal Patrol & Interdiction Craft
CSMP	- Current Ship's Maintenance Project
ECP	- Engineering Change Proposals
EIC	- Equipment Identification Code
EMC	- Electromagnetic Compatibility
EMI	- Electromagnetic Interference
EOC	- Extended Operating Cycle
FARADA	- Failure Rate Data Bank (Exchange Program)
FAST	- Fast Automatic Shuttle Transfer
FY	- Fiscal Year
HERF	- Hazards of Electromagnetic Radiation to Fuel
HERO	- Hazards of Electromagnetic Radiation to Ordnance
HM&E	- Hull, Mechanical, and Electrical
LMMEA	- LO-MIX Maintenance Engineering Analysis
LOE	- Light-Off Examination
LSP	- Logistic Support Planning
MDCS	- Maintenance Data Collection System
MDT	- Mean Downtime
MEA	- Maintenance Engineering Analysis
MRC	- Maintenance Requirement Card
MTBF	- Mean Time Between Failures
MTBM	- Mean Time Between Maintenance
MTTR	- Mean Time to Repair
NAVELEX	- Naval Electronics System Command
NOSC	- Naval Ordnance System Command
PEB	- Propulsion Examination Board
PMS	- Planned Maintenance Subsystem
POT&I	- Pre-Overhaul Test & Inspection

RADHAZ	- Radiation Hazard
RAV	- Restricted Availability
RF	- Radio Frequency
R&M	- Reliability and Maintainability
ROH	- Regular Overhaul
SARP	- Ship Alteration and Repair Package
SERVPAC	- Service Forces, Pacific Fleet
SF	- Ship's Force
SFOMS	- Ship's Force Overhaul Management System
SOR	- Specific Operational Requirements
SRF	- Ship Repair Facility
SSDI	- Ship Systems Definition and Index
SWBS	- Ship Work Breakdown Structure
TAOC	- Tactical Air Operations Center
TECHEVAL	- Technical Evaluation
TYCOM	- Type Commander
WSP	- Work System Package

CONTENTS

ABSTRACT	iii
ABBREVIATIONS	v
PART I — INTRODUCTION	1
PART II — TECHNIQUES SUPPORTING SHIPS MAINTENANCE MANAGEMENT	21
INDEX	169

ILLUSTRATIONS AND TABLES

Figure

1	Ship's Maintenance Management Techniques Resulting From or Applied in Selected ARINC Research Corporation Projects	5
2	Sample of Technique Description Sheet	11
3	Index of Techniques by Functional Area Supported	15
4	Classification of Techniques Based on Type, Cost and Effectiveness Parameters, and Applicability	19

Table

1	Listing of Functional Areas of Ship Maintenance Management Supported by Techniques Cataloged in Appendix A	13
---	--	----

PART I
INTRODUCTION

PART I - INTRODUCTION

ARINC Research Corporation has provided considerable support to the Navy in assisting the management of ship maintenance programs. Toward that end, the Corporation has applied a wide variety of techniques (some developed in-house) pertaining to maintenance management. This report catalogs these techniques on the basis of their characteristics and applications.

Figure 1 is a summary matrix of tasks accomplished by ARINC Research in support of ship maintenance management versus the techniques resulting from or applied in each of these projects. Each identified technique is cataloged in Part II of this report in the form of a Technique Description Sheet (see sample, Figure 2) containing the following information:

- a. Item No. - A sequence number in this catalog
- b. Title
- c. Description - A narrative statement identifying the technique in terms of its purpose and general application, and the procedural steps associated with its implementation. Where appropriate, the description is supplemented by figures, tables, or other information contributory to an understanding of the technique.
- d. Type of Technique - Identification of mechanical aspects of applying the technique - whether it includes a math model or computer program, whether it is essentially an engineering procedure (based on application of engineering principles) or a management procedure (based on management principles), etc. It should be noted that a given technique may involve more than one of the above categories, e.g., it may be classified as an engineering procedure and having a math model as its basis.
- e. Cost Parameters - The cost area that the technique addresses - development, procurement, installation, maintenance, operation, management/technical service, and modification.* In cases where the technique addresses total cost, the "Life Cycle" block is marked.

*These cost areas are defined in ARINC Research publication 509-01-2-564, Cost-Effectiveness Evaluation Procedures for Shipboard Electronic Equipment and Systems, Vol. I, Feb. 1966.

FIGURE 1

**SHIP'S MAINTENANCE MANAGEMENT
TECHNIQUES RESULTING FROM
OR APPLIED IN SELECTED
ARINC RESEARCH CORPORATION
PROJECTS (Sheet 1 of 3)**

PROJECT	Project/Task Topic	Customer	Contract No.	TECHNIQUE
	Reliability and Maintainability Data Feedback Systems	NASL	N00140-66-C-0151	1. Development of SSDIs for Ship Classes Using EIC
	Reliability and Maintainability Data Source Guide	NASL	N00140-66-C-0151	2. Development of SSDIs for Ship Classes Using EIC
	Availability of Data Sources for Navy Propulsion Systems	NASL	N00140-66-C-0151	3. C-E System Configuration Management SWBS
	CVA(N)-68 R&M Program		594-II-9999-T1	4. Anal. of Shipboard Eflex. Test Eq't. Reqmts & Allow.
	R&M Data Analysis, Retention, and Prediction Techniques for Boiler Systems	NAVSEC	N00189-68-C-0956	5. Validation of Shipait Status and Applicability
	Shipboard R&M Data Bank	NASL	N00140-68-D-0446	6. Reliability Prediction by Regression
	Reliability Prediction Procedure for Shipboard Mechanical Systems	NAVSHIPS	N00024-69-C-5554	7. Reliability Prediction by Regression
	Reliability Prediction for Ships Machinery	ARINC Research	Paper	8. Reliability Prediction by Regression
	Mk 46 Reliability Program	NUC	Various	9. Reliability Pred. by Summation of Failure Rates
	Shipboard Machinery R&M Data Bank	NAVSHIPS	N00024-72-C-5388	10. Reliability Demonstration Test Planning
	Validity of NAVSHIPS MDCS/ADP System	NAVSHIPS	N00024-72-C-5414	11. Determination of Shipboard Test Conduct
	Prepare Program Objectives Memorandum (POM) Estimates for Destroyer EOC	NAVSEA / PERA(CRUDES)	N00140-74-D-0090 (Task 9)	12. Reliability program Surveillance
	Long-Range Maintenance Plan for Surface Combatant Ships	NAVSEA / PERA(CRUDES)	N00140-74-D-0090 (Task 3)	13. Establishment of Mechanical Parts Data Bank
	Annual Maint. Cost and Feasibility of Adopting EOC for Destroyers	NAVSEA / PERA(CRUDES)	N00140-73-D-0074 (Task 14)	14. Data Collection & Analysis of Shipboard Mech. Equip. Problems
	Major Maintenance Burden Equipment for Destroyers	NAVSEA / PERA(CRUDES)	N00140-74-D-0090 (Task 5)	15. Ident. of Shipboard Mech. Equip. Problems
				16. Engineering Assessment of Sys. /Eq't. Reliability
				17. Structural Design Analysis
				18. Failure Analysis by Engineering Investigation
				19. Failure Analysis by Laboratory Testing
				20. Fault Isolation Procedure Analysis
				21. Maintainability Prediction by Regression
				22. Maintainability Demonstration Test Planning
				23. Maintainability Demonstration by Regression
				24. LO-MIX Maintenance Demonstration Test Planning
				25. Maintenance Engineering Test Conduct
				26. Anal. History Analysis

	Task ID	Description	Status
X	1.8.	Failure Analysis by Eqn. Reliability	
X	1.9.	Failure Analysis by Engineering Investigation	
X	20.	Fault Isolation Procedure Testing	
X	21.	Maintainability Prediction by Laboratory Testing	
X	22.	Maintainability Prediction by Regression	
X	23.	Maintainability Demonstration Test Planning	
X	24.	LO-MIX Maintenance Demonstration Test Planning	
X	25.	Maintenance Engineering Test Conduct	
X	26.	Anal. of Maintenance History Analysis	
X	27.	Engineering Analysis of Propulsion Equipment	
X	28.	Anal. of Shipboard Resource Consumption	
X	29.	B&M Indices for Shipboard Maint. & Cost	
X	30.	Development of Equipment Factors	
X	31.	Analysis of Equipment Behavior Measures	
X	32.	Measurement/Assessment Effectiveness	
X	33.	Life Cycle Cost Assessment of Ship Material	
X	34.	Development Categorization of Ship Material Condition	
X	35.	Determination of Cost Estimating Relationships	
X	36.	Eval. of Annualized Maint. Cost for Ships	
X	37.	Extended Operating Cycle (EOC) Program planning	
X	38.	EOC Systems Analysis	
X	39.	Development of EOC Interval	
X	40.	Development of Class-Level Critical Equipment	
X	41.	Preparation of Ship Class Baseline Repair List	
X	42.	Management Plan for Technical Repair Profile	
X	43.	PFB/LOE Preparation for Use in LOE Standards	
X	44.	Pre-Overhaul Preparation Program	
X	45.	Shipcheck Training Program	
X	46.	ROH Advance Planning	
X	47.	Pre-Overhaul Planning Using Network of Significant Activities	
X	48.	Development of Standardized Work Requests	
X	49.	Scoping and Estimation of Significant Procedure	
X	50.	Est. of Non-Industrial Labor Requirements	
X	51.	Effectiveness Analysis of Ship's Force ROH Work	
X	52.	Economic Analysis of Ship's Regular Overhaul	
X	53.	EMC/EMI Instruction of Ship's Regular Overhaul	
X	54.	EMI Susceptibility Evaluation	
X	55.	Logistics Management Information System	
X	56.	Logistics Management Information System	
X	57.	Procedure of Equipment Data Program	
X	58.	Development of Equipment Procurement Specs	
X	59.	Development of Spare Parts Improvement Surveys	
X	60.	Det. of Spare Parts Inventory for Weapon Plans	
X	61.	Logistics Support Planning for Ship Class	
X	62.	Specific Operational Requirements (SOR) Review	
X	63.	Analysis of Mission Requirements and ROH Cycle	

(Figure 1)

FIGURE 1. (Sheet 2 of 3)

PROJECT			TECHNIQUE
Project/Task Topic	Customer	Contract No.	
Simulation Model for Relating Mission Requirements to Regular Overhaul Cycles	DESLANT / PERA(CRUDES)	N00140-73-D-0074 (Task 9)	1. Development of SSDIs for Ship Classes Using EIC
Pre-ROH Indoctrination Program	PERA(CRUDES)	N00140-74-D-9990 (Task 6)	2. Development of SSDIs for Ship Classes Using EIC
Maintenance Management Guide	COMSERVPAC	N00604-73-C-0450 (Task 1)	3. C-E System Configuration Management SWBS
ATF ROH Standard Work Package	COMSERVPAC / PERA(CSS)	N00604-73-C0450 (Task 2)	4. Anal. of Shipboard Eflex Test Eq't. Reqs & Allow.
Technique for Measuring Ships Material Condition	COMSERVPAC	N00604-73-C0450 (Task 3)	5. Validation of Shipalt Status and Applicability
Staging Diagrams (Using EIC)	COMSERVPAC	N00604-71-C-0431	6. Evaluation of Shipalt Status and Applicability
Engineering Support to Service Force, Pacific	COMSERVPAC	N00604-71-C-0431	7. Reliability prediction of ECPS
ROH Planning Logic Network, Policies, Procedures	COMSERVPAC	N00604-71-C-0431	8. Reliability prediction by Regression
Habitability Manual	COMSERVPAC	N00604-71-C-0431	9. Reliability Pred. by Summation of Failure Rates
Technical Repair Standards	NAVSEA / PERA(CRUDES)	N00140-73-D-0074; N00140-74-D-0090	10. Reliability Demonstration Test Planning
SFOMS Implementation Assistance and ROH Planning to Selected Ships	PERA(CRUDES) / PERA(CSS)	Various	11. Determination of Parts Data Bank
T-ATF 164 Logistics Support Planning	NAVSEA	N00600-74-D-0597	12. Reliability Program Surveillance
Logistics Support Management and MIS System for Vietnamese Navy	COMNAVFOR	DAJB-01-73-C-0007	13. Establishment of Mechanical Parts Data Bank
Communications and Electronics Shipalt Analysis	COMSERVPAC	N00604-73-C-0230	14. Data Collection and Analysis
			15. Ident. of Shipboard Mech. Equip. Problems
			16. Engineering Assessment of Sys./Eq't. Reliability
			17. Structural Isolation by Laboratory Testing
			18. Failure Analysis of Sys./Eq't. Reliability
			19. Failure Analysis by Engineering Investigation
			20. Fault Isolation Procedure Analysis
			21. Maintainability Prediction by Regression
			22. Maintainability Demonstration Test Planning
			23. Maintainability Demonstration Test Planning
			24. LO-MIX Maintenance Engineering Test Conduct
			25. Maintenance Engineering Test Conduct
			26. Anal. of Corrective Maintenance History
			27. Engin.

Item	Description	Owner	Review Status
18. Failure Design Analysis	Failure Analysis by Sys./Eqt. Reliability		
19. Failure Analysis by Engineering Investigation	Fault Isolation Procedure Analysis		
20. Fault Isolation by Laboratory Testing	Maintainability Prediction by Regression		
21. Maintainability Demonstration	LO-MIX Maintenance Demonstration Test Planning		
22. Maintainability Test Conduct	Maintenance Engineering Analysis		
23. Maintainability Analysis	Anal. of Corrective Maint. Resource Consumption		
24. LO-MIX Maintenance Test Planning	Anal. of Shipboard Mech. Eqt. Maint. & Cost Factors	X	
25. Maintenance Test Conduct	Analysis of Equipment Equipments		
26. Anal. History Analysis	Analysis of PMS Effectiveness		
27. Engineering Assessment	Measurement/Assessment of Measures		
28. Anal. of Propulsion Equipment	Life Cycle Cost Categorization		
29. Anal. of Resource Consumption	Determination of Cost Estimating Condition		
30. R&M Indices for Shipboard Maint.	Evaluation of Annualized Relationships		
31. Development of Equipment	Extended Operating Cost for Ships		
32. Analysis of Equipment	OCO Program Interval		
33. Analysis of PMS	Development of Class-Level Program Planning		
34. Life Cycle Cost	Preparation of Ship Critical Equipment List		
35. Cost Categorization	Management Plan for Technical Repair Profile	X	
36. Determination of Condition	PEB/LOE Preparation		
37. Evaluation of Relationships	Pre-Overhaul Training Program		
38. Extended Operating Cycle	Shipcheck Planning		
39. OCO Program Interval	ROH Advance Planning		
40. Development of Program Planning	Pre-Overhaul Training of Ship Personnel		
41. Preparation of Critical Equipment	Pre-Overhaul Planning		
42. Management Plan	Pre-Overhaul Test and Inspection Network		
43. Technical Repair Profile	Scoping and Standardized Work Requests		
44. PEB/LOE Preparation	Est. of Non-Industrial Labor Requirements		
45. Pre-Overhaul Training Program	Effectiveness Analysis of Ship's Regular Overhaul		
46. Shipcheck Planning	Economic Analysis of Ship's Regular Overhaul		
47. ROH Advance Planning	EMC/EMI Instruction		
48. Pre-Overhaul Planning	Logistics Management Evaluation		
49. Pre-Overhaul Test and Inspection Network	Logistics Management Information System		
50. Scoping and Standardized Work Requests	Development of Equipment Data Program		
51. Est. of Non-Industrial Labor Requirements	Procedure for Cond. Shipboard Habitability Surveys		
52. Effectiveness Analysis of Ship's Regular Overhaul	Development of Cond. Shipboard Habitability Surveys		
53. Economic Analysis of Ship's Regular Overhaul	Det. of Spare Parts Inventory for Weapon Systems		
54. EMC/EMI Instruction	Specific Operational Planning for Ship Class		
55. Logistics Management Evaluation	Analysis of Mission Requirements (SOR) Review	X	
56. Logistics Management Information System	Support Planning for Weapon System		
57. Development of Equipment Data Program	Development of Cond. Shipboard Habitability Surveys		
58. Procedure for Cond. Shipboard Habitability Surveys	Det. of Spare Parts Inventory for Weapon Systems		
59. Development of Cond. Shipboard Habitability Surveys	Development of Cond. Shipboard Habitability Surveys		
60. Det. of Spare Parts Inventory for Weapon Systems	Development of Cond. Shipboard Habitability Surveys	X	
61. Logistics Management Evaluation	Development of Cond. Shipboard Habitability Surveys		
62. Specific Operational Planning for Ship Class	Development of Cond. Shipboard Habitability Surveys		
63. Analysis of Mission Requirements (SOR) Review	Development of Cond. Shipboard Habitability Surveys		

(Figure 1)

FIGURE 1. (Sheet 3 of 3)

PROJECT			TECHNIQUE
Project/Task Topic	Customer	Contract No.	1. Development of SSDIs for Ship Classes Using EIC
LO-MIX Ships Maintenance Engineering Analysis Technique	NAVSEA	N00123-73-C-1698	2. Development of SSDIs for Ship Classes Using EIC
Management Planning and Implementation Support for PEB/LOE	PERA(CRUDES)	N00140-73-D-0074; N00140-74-D-0090	3. C-F System Configuration Management SWBS
Maintenance History Analysis for Destroyer Propulsion System Equipments	NAVSEA/ PERA(CRUDES)	Various	4. Anal. of Shipboard Flex. Test Eqt. Regmts & Allow.
R&M Indices for Destroyer Propulsion System Equipments	CNO	N00014-74-C-0216	5. Validation of Shipalt Status and Applicability
Shipboard Ordnance and Fire Control System R, M, and Logistics Studies	NOS/Lsvl, NOL/NMEF	Various	6. Evaluation of ECPs
Application of Ships Staging Diagrams for DE-1052 (Using SWBS)	PHNSY	N00604-75-C-0015	7. Reliability Prediction by Regression
SFOMS Standards	PERA(CRUDES)	N00140-74-D-0090	8. Reliability Pred. by Summation of Failure Rates
SSDIs for DDG-2 Class Ships	PERA(CRUDES)	N00140-74-D-0090	9. Reliability Demonstration Test Planning
Shipboard Electronic Equipment Study	PERA(CSS)	N66314-74-C-2497 "CL"	10. Determination of Shipboard Test Conduct
Comm Elex Configuration Analysis	COMSERVPAC	N00604-73-C-0181 "CL"	11. Reliability Program Surveillance
Engineering Support to Underwater Systems	NUC	Various	12. Reliability Data Collection & Analysis
Sonobuoy Studies	NADC	Various	13. Data Collection of Mechanical Parts Data Bank
FAST System R&M Assessment	NAVSHIPS	N00024-68-C-5326	14. Ident. of Shipboard Mech. Equip.
Destroyer Engineered Oper. Cycle	PMS 934	Various	15. Fault Isolation Procedures Analysis
SARP Development	PERA(CRUDES)	N00140-74-D-0090 (Task 7)	16. Engineering Assessment of Sys. /Eqt. Reliability
Post-ROH Analysis	PERA(CSS) COMSERVPAC	Various	17. Structural Design Analysis
			18. Failure Analysis by Engineering Investigation
			19. Failure Analysis by Laboratory Testing
			20. Maintainability Prediction by Regression
			21. Maintainability Demonstration Test Planning
			22. Maintainability Demonstration Test Conduct
			23. Maintenance History Analysis
			24. LO-MIX Maintenance History Analysis
			25. Maintenance Engineering Analysis
			26. Anal. of Corrective Measures
			27. Engin...

X	17. Structural Assessment of Sys., Problems, Equip.
X	18. Failure Analysis of Sys./Eq.
X	19. Failure Analysis by Engg. Investigation
X	20. Fault Isolation
X	21. Maintainability Testing
X	22. Maintainability Procedures Analysis
X	23. Maintainability Prediction by Regression
X	24. Maintainability Demonstration Test Planning
X	25. LO-MIX Maintenance Demonstration Test Planning
X	26. Maintenance Engineering Test Conduct
X	27. Anal. of Corrective History Analysis
X	28. Anal. of Propulsion Equipment
X	29. Anal. of Resource Consumption
X	30. R&M Indices for Maint. & Cost
X	31. Development of Shipboard Equipment Cost Factors
X	32. Analysis of PMS Effectiveness
X	33. Measurement/Accuracy
X	34. Life Cycle Cost Estimation of Ship Material Condition
X	35. Development of Cost Categorization
X	36. Determination of Annualized Relationships
X	37. Evaluation of Feasibility of Extended Maint. Cost
X	38. Extended Operating Cycle (EOC) Program Interval
X	39. EOC Systems Analysis
X	40. Development of Class-Level Critical Equipment
X	41. Preparation of Ship Class Baseline Repair List
X	42. Management Plan for Technical Repair Profile
X	43. PEB/LOE Preparation Overhaul Interval
X	44. Pre-Overhaul Preparation Program
X	45. Shipcheck Planning
X	46. ROH Advance Planning
X	47. Pre-Overhaul Planning Using Network
X	48. Development of Significant Activities
X	49. Scoping and Standardized Work Requests
X	50. Est. of Non-Industrial Labor Requirements
X	51. Effectiveness Analysis of ROH Work
X	52. Economic Analysis of SF During ROH
X	53. EMC/EMI Analysis of Ship's Regular Overhaul
X	54. EMI Susceptibility Evaluation
X	55. Logistics Management Information System
X	56. Development of Equipment Data Program
X	57. Procedure for Cond. Procurement Specs
X	58. Development of Habitability Improvement Surveys
X	59. Specific Operational Planning for Weapon System
X	60. Analysis of Mission Requirements (SOR) Review and ROH Cycle

(Figure 1)

TECHNIQUE DESCRIPTION SHEET

1. Item No.	2. Title			
3. Description				
DESIGN	4. Type of Technique	5. Cost Parameters	6. Effectiveness Parameters	7. Status
	Math Model	Life Cycle	Effectiveness	Concept
	Computer Program	Development	Perf. Capability	Technique Developed, Not Applied
	Engineering Procedure	Procurement	Availability	
	Management Procedure	Installation	Reliability	Technique Applied One Time
		Maintenance	Maintainability	Technique Applied Recurrently
		Operation	None	
		Mgt/Tech Service		
		Modification		
		None		
APPLICATION	8. Type of System/Equipment	9. Life Cycle Phase	10. Functional Areas Supported	
	Total Ship	Concept Form.		
	Hull Structure	Validation		
	Propulsion	Development		
	Electric Plant	Acquisition		
	Command & Surv.	Operation		
	Auxiliaries			
	Outfit/Furnish.			
11. References (ARINC Research Corporation publications unless otherwise indicated)				

Figure 2. Sample of Technique Description Sheet

In cases where the technique does not address any aspect of cost, the "None" block is marked.

- f. Effectiveness Parameters – The aspect of system effectiveness that the technique addresses, i.e., performance capability, availability, reliability, maintainability, or other effectiveness elements. Techniques that do not specifically address any of these parameters are classified "None".
- g. Status – The status of the technique, i.e.:
 - 1) The technique exists in conceptual form, but requires further development before it can be applied.
 - 2) The technique has been sufficiently developed to permit application, but application hasn't as yet been attempted.
 - 3) The technique has been applied once to date.
 - 4) The technique has been applied recurrently.
- h. Type of System/Equipment – The specific ship system to which the technique applies, based on the first level of definition in the Ship Work Breakdown Structure (SWBS). Techniques applicable to an entire ship are marked "Total Ship". Techniques limited in their application to a particular type of ship are so indicated at the bottom of block 8 by a filled-in notation of ship type.
- i. Life Cycle Phase – The life cycle phase(s) to which the technique applies – concept formulation, development, validation, acquisition, or operation.
- j. Functional Areas Supported – The functional area(s) of ship maintenance management that the technique supports. These functional areas are listed alphabetically in Table 1. Each Technique Description Sheet lists in block 10 the particular areas from Table 1 that the technique supports.
- k. References – Those publications, both of ARINC Research and the government, that either describe the technique or illustrate its application.

**TABLE 1. LISTING OF FUNCTIONAL AREAS OF SHIP MAINTENANCE
MANAGEMENT SUPPORTED BY TECHNIQUES CATALOGED IN APPENDIX A**

a. Configuration Management	x. Maintenance Program Management Information System
b. Criticality (of Equipment) Ranking	y. Material Condition Assessment
c. Electrical Design Analysis	z. Pre-Overhaul Test and Inspection
d. Electronic Test Equipment	aa. Planned Maintenance System
e. EMI/EMC	bb. Production Planning and Control
f. EOC Maintenance Management	cc. Reliability Demonstration
g. Failure Analysis	dd. Reliability Engineering Analysis
h. Fleet Modernization Program	ee. Reliability Measurement
i. Habitability	ff. Reliability Prediction
j. Life Cycle Cost Analysis	gg. Reliability Program Evaluation
k. Light-Off Examination	hh. Reliability Trend Analysis
l. Logistics Management Information System	ii. ROH Cost Analysis
m. Logistic Management Program	jj. ROH Effectiveness Analysis
n. Logistic Support Planning	kk. ROH Planning
o. Maintainability Demonstration	ll. ROH Work Package Development
p. Maintainability Measurement	mm. Ship's Force Overhaul Management System
q. Maintainability Prediction	nn. Spares Inventory Determination
r. Maintainability Trend Analysis	oo. Specific Operational Requirements
s. Maintenance Budgeting	pp. Structural Design Analysis
t. Maintenance Cost Analysis	qq. Testing
u. Maintenance Engineering Analysis	rr. Training
v. Maintenance Manpower Analysis	
w. Maintenance Strategy Planning	

The Technique Description Sheet also shows areas in which the methodologies have potential utility, although not yet applied by ARINC Research. An "X" in blocks 4 through 9 indicates current characteristics and applicability, and the letter "P" denotes potential characteristics or applicability. For example, certain techniques may be marked in block 8 with an "X" opposite "Propulsion" and a "P" opposite "Electric Plant". This reflects the fact that the technique has been applied to propulsion system equipment and could be applied to electric plant equipment.

Figure 3 is a matrix showing the specific functional areas supported by each of the techniques cataloged in Part II. Additional visibility is provided by Figure 4, which summarizes the techniques in terms of their classification(s) by:

- a. Type of technique
- b. Cost parameters
- c. Effectiveness parameters
- d. Status
- e. Type of ships system/equipment
- f. Life cycle phase

FIGURE 3
INDEX OF TECHNIQUES BY
FUNCTIONAL AREA SUPPORTED
(Sheet 1 of 2)

Functional Area		TECHNIQUE		
Functional Area		1. Development of SSDIs for Ship Classes Using E/C	2. Development of SSDIs for Ship Classes Using EIC	3. C-E System Configuration Management
Configuration Management	X	X	X	
Criticality (of Equipment) Ranking				X
Electrical Design Analysis				
Electronic Test Equipment		X		
EMI/EMC				
EOC Maintenance Management				
Failure Analysis				
Fleet Modernization Program (FMP)	X	X		
Habitability				
Life Cycle Cost Analysis				
Light-Off Examination (LOE)				
Logistics Management Information System				
Logistic Management Program				
Logistic Support Planning				
Maintainability Demonstration				
Maintainability Measurement			X	X
Maintainability Prediction			X	
Maintainability Trend Analysis				X
Maintenance Budgeting				
Maintenance Cost Analysis			X	
Maintenance Engineering Analysis			X	X
Maintenance Manpower Analysis				X

	Inventory Preparation										Procedural Testing									
	M&R					Logistics					PMS					S&T				
21. Maintenance Procedures Analysis	X																			
22. Maintainability Prediction by Regression		X																		
23. Maintainability Demonstration			X																	
24. LO-MIX Maintenance Demonstration Test Planning				X																
25. Maintenance Engineering Test Conduct					X															
26. Analysis of Corrective Maint. Resource Consumption						X														
27. Engineering Assessment of Propulsion Equipment							X													
28. Analysis of PMS Effectiveness Measures								X												
29. R&M Indices for Shipboard Equip. Maint. & Cost Factors									X											
30. Development of Shipboard Equipments										X										
31. Analysis of Equipment Behavior											X									
32. Measurement/Assessment of Ship Material Condition												X								
33. Life Cycle Cost Assessment of Ship Material Condition													X							
34. Development of Cost Estimating Relationships														X						
35. Determination of Annualized Maint. Cost for Ships															X					
36. Evaluation of Feasibility of Extending Overhaul Interval																X				
37. Extended Operating Cycle (EOC) Program Planning																	X			
38. F/C Systems Analysis																		X		
39. Development of Class-Level Critical Equipment List																			X	
40. Preparation of Ship Class Baseline Repair Profile																				X
41. Management Plan for Use in LOE Preparation																				
42. Pre-Overhaul Preparation Program																				
43. Pre-Overhaul Training of Ship Personnel																				
44. Pre-Overhaul Test and Inspection Network of Significant Activities																				
45. Scoping and Standardized Work Requests																				
46. Est. of Non-Industrial Labor Requirements																				
47. Economic Analysis of Ship's Regular Overhaul																				
48. Logistics Management Information System																				
49. Procedure of Equipment Data Program																				
50. Development of Equipment Procurement Specs																				
51. Development of Habitability Improvement Surveys																				
52. Logistical Susceptibility Evaluation																				
53. EMC/EMI Instruction																				
54. Logistics Management Information System																				
55. Procedure for Cond. Shipboard Habitability Surveys																				
56. Development of Spare Parts Inventory for Weapon System																				
57. Specific Operational Requirements (SOR) Review																				
58. Analysis of Mission Requirements and ROH Cycle																				

(Figure 3)

FIGURE 3. (Sheet 2 of 2)

FUNCTIONAL AREA		TECHNIQUE		
Functional Area				
Maintenance Strategy Planning		1. Development of SSDIs for Ship Classes Using EIC		
Material Condition Assessment		2. Development of SSDIs for Ship Classes Using EIC		
Pre-Overhaul Test & Inspection (POT&I)	X	3. C-E System Configuration Management SWBS		
Planned Maintenance System (PMS)		4. Anal. of Shipboard E/Flex. Test Eqt. Reqmts & Allow.		
Procurement Specification Development		5. Validation of Shipboard Status and Applicability		
Production Planning and Control		6. Evaluation of ECPs		
Reliability Demonstration		7. Reliability Prediction by Regression		
Reliability Engineering Analysis		8. Reliability Pred. by Summation of Failure Rates		
Reliability Measurement		9. Reliability Demonstration Test Planning		
Reliability Prediction		10. Reliability Demonstration Test Conduct		
Reliability Program Evaluation		11. Reliability Demonstration Test Surveillance		
Reliability Trend Analysis		12. Reliability Program Surveillance		
ROH Cost Analysis		13. Establishment of Sys./Eqt. Figures of Merit		
ROH Effectiveness Analysis	X	14. Data Collection of Mechanical Parts Data Bank		
ROH Planning	X	15. Ident. of Shipboard Mech. Equip. Problems		
ROH Work Package Development		16. Engineering Assessment of Sys./Eqt. Problems		
Ship's Force Overhaul Mgt. Sys. (SFOMS)		17. Structural Design Analysis		
Specific Operational Requirements		18. Failure Analysis by Eqt. Reliability		
Spares Inventory Determination		19. Failure Analysis by Engineering Investigation		
Structural Design Analysis		20. Fault Isolation by Laboratory Testing		
Testing		21. Maintenance Procedures Analysis		
Training		22. Maintainability Prediction by Regression		
		23. Maintainability Demonstration by Regression		
		24. LO-MIX Maintenance Demonstration Test Planning		
		25. Maintenance History Engineering Analysis		
		26. Anal. of Corrective Maint. Resource Consumption		
		27. Engineering Assessment of Propulsion Equipment		
		28. Anal. of Shipboard Mech. Eqt. Maintenance		
		29. R&M Indices for Ship Material Condition		
		30. Development of Shipboard Equipment		
		31. Analysis of Equipment Behavior Factors		
		32. Measurement/Assessment of Ship Material Condition		
		33. Life Cycle Cost Categorization		
		34. Development of Cost Estimating Relationships	X	
		35. Determination of Annualized Reliability	X	
		36. Eval. of Feasibility	X	

	Section	Part	Description
16.	Ient.	Parts Data Bank	
16.	Engineering of Shipboard Mech. Equip.	Engineering of Shipboard Mech. Equip.	
17.	Structural Assessment of Sys.	Structural Assessment of Sys.	
18.	Failure Design Analysis	Failure Design Analysis	
19.	Failure Analysis by Engineering	Failure Analysis by Engineering	
20.	Fault Isolation by Laboratory Investigation	Fault Isolation by Laboratory Investigation	
21.	Maintainability Procedures Analysis	Maintainability Procedures Analysis	
22.	Maintainability Prediction Analysis	Maintainability Prediction Analysis	
23.	Maintainability Demonstration by Regression	Maintainability Demonstration by Regression	
24.	LO-MIN Demonstration Test Planning	LO-MIN Demonstration Test Planning	
25.	Maintenance Engineering Test Conduct	Maintenance Engineering Test Conduct	
26.	Anal. of Maintenance History Analysis	Anal. of Maintenance History Analysis	
27.	Engineering Maint. Resource Consumption	Engineering Maint. Resource Consumption	
28.	Anal. of Shipboard Maint. Resource Consumption	Anal. of Shipboard Maint. Resource Consumption	
29.	R&M Indices for Shipboard Maint. & Cost Factors	R&M Indices for Shipboard Maint. & Cost Factors	X
30.	Development of Shipboard Equipment	Development of Shipboard Equipment	X
31.	Analysis of Equipment Behavior Measures	Analysis of Equipment Behavior Measures	X
32.	Measurment/PMS Effectiveness	Measurment/PMS Effectiveness	X
33.	Life Cycle/Assessment of Ship Material Condition	Life Cycle/Assessment of Ship Material Condition	X
34.	Development Cost Categorization	Development Cost Categorization	X
35.	Determination of Cost Estimating Relationships	Determination of Cost Estimating Relationships	X
36.	Ext. of Annualized Maint. Cost for Ships	Ext. of Annualized Maint. Cost for Ships	X
37.	Extended Operating Cycle (EOC) program Planning	Extended Operating Cycle (EOC) program Planning	X
38.	Pre-Overhaul Interval	Pre-Overhaul Interval	X
39.	Pre-Overhaul Preparation	Pre-Overhaul Preparation	X
40.	Pre-Overhaul Program Planning	Pre-Overhaul Program Planning	X
41.	Preparation of Ship Class Baseline Repair List	Preparation of Ship Class Baseline Repair List	X
42.	Management Plan for Use in LOF Profile	Management Plan for Use in LOF Profile	X
43.	PEB/LOF Preparation	PEB/LOF Preparation	X
44.	Pre-Overhaul Training Program	Pre-Overhaul Training Program	X
45.	Shipcheck Planning of Ship Personnel	Shipcheck Planning of Ship Personnel	X
46.	ROH Advance Planning	ROH Advance Planning	X
47.	Pre-Overhaul Using Network of Significant Activities	Pre-Overhaul Using Network of Significant Activities	X
48.	Development of Standardized Work Requests	Development of Standardized Work Requests	X
49.	Scoping and Estimation of Ship's Force ROH Work	Scoping and Estimation of Ship's Force ROH Work	X
50.	Economic Analysis of Ship's Regular Overhaul	Economic Analysis of Ship's Regular Overhaul	X
51.	Effectiveness Analysis of Ship's Regular Overhaul	Effectiveness Analysis of Ship's Regular Overhaul	X
52.	Logistics Management Information System	Logistics Management Information System	X
53.	Procedure for Cond. Shipboard Procurement Specs	Procedure for Cond. Shipboard Procurement Specs	X
54.	Development of Equipment Procurement Specs	Development of Equipment Procurement Specs	X
55.	Development of Spare Parts Inventory for Weapon System	Development of Spare Parts Inventory for Weapon System	X
56.	Support Planning for Ship Class	Support Planning for Ship Class	X
57.	Analysis of Mission Requirements and ROH Cycle	Analysis of Mission Requirements and ROH Cycle	X

(Figure 3)

FIGURE 4
**CLASSIFICATION OF TECHNIQUES
 BASED ON TYPE, COST AND
 EFFECTIVENESS PARAMETERS,
 AND APPLICABILITY**

CHARACTERISTIC/APPLICATION

LIFE CYCLE PHASE	TYPE OF SYSTEM/EQUIPMENT	STATUS	EFFECTIVENESS PARAMETERS	COST PARAMETERS	TYPE OF TECHNIQUE	TECHNIQUE
					1. Development of SSDIs for Ship Classes Using EIC	1. Development of SSDIs for Ship Classes Using EIC
					2. Development of SSDIs for Ship Classes Using EIC	2. Development of SSDIs for Ship Classes Using EIC
					3. C-E System Configuration Management SWBS	3. C-E System Configuration Management SWBS
					4. Anal. of Shipboard Elex. Test Eq't. Requirements & Allow.	4. Anal. of Shipboard Elex. Test Eq't. Requirements & Allow.
					5. Validation of Shipboard Status and Applicability	5. Validation of Shipboard Status and Applicability
					6. Evaluation of Shipboard Status and Applicability	6. Evaluation of Shipboard Status and Applicability
					7. Reliability Prediction by Regression	7. Reliability Prediction by Regression
					8. Reliability Prediction by Regression	8. Reliability Prediction by Regression
					9. Reliability Pred. by Summary of Failure Rates	9. Reliability Pred. by Summary of Failure Rates
					10. Reliability Demonstration Test Planning	10. Reliability Demonstration Test Planning
					11. Determination of Shipboard System Figures of Merit	11. Determination of Shipboard System Figures of Merit
					12. Reliability Analysis by Engineering Investigation	12. Reliability Analysis by Engineering Investigation
					13. Engineering Assessment of Sys./Eq't. Reliability	13. Engineering Assessment of Sys./Eq't. Reliability
					14. Data Collection of Mechanical Parts Data Bank	14. Data Collection of Mechanical Parts Data Bank
					15. Ident. of Shipboard Mech. Equip. Problems	15. Ident. of Shipboard Mech. Equip. Problems
					16. Structural Design Analysis of Sys./Eq't. Reliability	16. Structural Design Analysis of Sys./Eq't. Reliability
					17. Failure Analysis by Isolation Testing	17. Failure Analysis by Isolation Testing
					18. Failure Analysis by Laboratory Testing	18. Failure Analysis by Laboratory Testing
					19. Failure Analysis by Engineering Investigation	19. Failure Analysis by Engineering Investigation
					20. Fault Isolation by Engineering Investigation	20. Fault Isolation by Engineering Investigation
					21. Maintenance Procedure Analysis	21. Maintenance Procedure Analysis
					22. Maintainability Prediction by Regression	22. Maintainability Prediction by Regression
					23. Maintainability Demonstration Test Planning	23. Maintainability Demonstration Test Planning
					24. LO-MIX Maintenance Demonstration Test Planning	24. LO-MIX Maintenance Demonstration Test Planning
					25. Maintenance History Engineering Test Conduct	25. Maintenance History Engineering Test Conduct
					26. Anal. of Corrective Maint. Resource Consumption	26. Anal. of Corrective Maint. Resource Consumption
					27. Engineering Analysis of Propulsion Equipment	27. Engineering Analysis of Propulsion Equipment
					28. Anal. of Shipboard Equipment Behavior Measures	28. Anal. of Shipboard Equipment Behavior Measures
					29. RAM Indices for Ship Material Condition	29. RAM Indices for Ship Material Condition
					30. Development of Shipboard Equipment Factors	30. Development of Shipboard Equipment Factors
					31. Analysis of Equipment Behavior Measures	31. Analysis of Equipment Behavior Measures
					32. Measurement of PMS Effectiveness	32. Measurement of PMS Effectiveness
					33. Life Cycle Cost Assessment of Ship Material Condition	33. Life Cycle Cost Assessment of Ship Material Condition
					34. Development of Shipboard Material Condition	34. Development of Shipboard Material Condition
					35. Determination of Cost Estimating Relationships	35. Determination of Cost Estimating Relationships
					36. Eval. of Annualized Maint. Cost for Ships	36. Eval. of Annualized Maint. Cost for Ships
					37. Extended Operating Cycle (EOC) Development	37. Extended Operating Cycle (EOC) Development
					38. EOC Systems Analysis	38. EOC Systems Analysis

X = Applicable; P = Potentially applicable.

Part of Shipboard System		Figures of Merit	
X	X	X	13. Establishment of Surveillance Program
X	X	X	14. Data Collection of Mechanical Parts
X	X	X	15. Ident. of Analysis Problems
X	X	X	16. Analysis of Shipboard Data Bank
X	X	X	17. Engineering Assessment of Equip. Problems
X	X	X	18. Structural Design Analysis
X	X	X	19. Failure Analysis / Eqt. Reliability
X	X	X	20. Fault Analysis by Engineering Investigation
X	X	X	21. Fault Isolation Procedure Testing
X	X	X	22. Maintainability Prediction
X	X	X	23. Maintainability Demonstration by Regression
X	X	X	24. LO-MIX Maintenance Demonstration Test Planning
X	X	X	25. Maintenance Engineering Test Conduct
X	X	X	26. Anal. of Corrective Maintenance History
X	X	X	27. Anal. of Propulsion Equipment
X	X	X	28. Anal. of Resource Consumption
X	X	X	29. Anal. of Shipboard Maint. & Consumption
X	X	X	30. R&M Indicators for Shipboard Maint. & Cost
X	X	X	31. Development of Equipment Behavior Factors
X	X	X	32. Analysis of PMS Effectiveness
X	X	X	33. Measurement/Accuracy Measures
X	X	X	34. Life Cycle Cost Categorization
X	X	X	35. Development of Ship Material Condition
X	X	X	36. Determination of Cost Estimating Relationships
X	X	X	37. Eval. of Annualized Maint. Cost for Ships
X	X	X	38. Extended Operating Cycle (EOC) Program Interval
X	X	X	39. Development of Class-Level Program Planning
X	X	X	40. Development of Critical Equipment List
X	X	X	41. Preparation of Ship Class Baseline Repair Profile
X	X	X	42. Management Plan for Use in LOE Preparation
X	X	X	43. PEB/LOE Preparation Program
X	X	X	44. Pre-Overhaul Training Program
X	X	X	45. Shipcheck Planning
X	X	X	46. ROH Advance Planning
X	X	X	47. Pre-Overhaul Using Network of Significant Activities
X	X	X	48. Development of Standardized Work Procedure
X	X	X	49. Scoping and Estimation of Work Requests
X	X	X	50. Est. of Non-Industrial Labor Requirements
X	X	X	51. Effectiveness Analysis of Ship's Regular Overhaul
X	X	X	52. Economic Analysis of Ship's Regular Overhaul
X	X	X	53. EMC/EMI Instruction
X	X	X	54. EMI Susceptibility Evaluation
X	X	X	55. Logistics Management Information System
X	X	X	56. Development of Equipment Data Program
X	X	X	57. Development of Shipboard Habitability Specs.
X	X	X	58. Det. of Spare Parts Inventory for Weapon Systems
X	X	X	59. Development of Shipboard Habitability Surveys
X	X	X	60. Logistics Support Planning for Weapon Systems
X	X	X	61. Specific Operational Requirements for Ship Class
X	X	X	62. Analysis of Mission Requirements (SQR) Review
X	X	X	63. Analysis of Mission Requirements and ROH Cycle

(Figure 4)

PART II
TECHNIQUES SUPPORTING SHIPS
MAINTENANCE MANAGEMENT

**PART II – TECHNIQUES SUPPORTING SHIPS
MAINTENANCE MANAGEMENT**

<u>Item</u>	<u>Title</u>	<u>Page</u>
1	Development of Ship Systems Definition and Index for Ship Classes Using Equipment Identification Code	27
2	Development of Ship Systems Definition and Index for Ship Classes Using Ship Work Breakdown Structure	31
3	Communication Electronics Systems Configuration Management Analysis	35
4	Comparative Analysis of Shipboard Electronic Test Equipment Requirements and Allowances	37
5	Validation of Shipalt Status and Applicability	39
6	Evaluation of Engineering Change Proposals	41
7	Reliability Prediction (of Mechanical Shipboard Equipments) by Regression	43
8	Reliability Prediction by Summation of Failure Rates	45
9	Reliability Demonstration Test Planning	47
10	Reliability Demonstration Test Conduct	49
11	Determining Shipboard System Figures of Merit	51
12	Reliability Program Surveillance	53
13	Establishment of Mechanical Parts Data Bank	55
14	Data Collection and Analysis of Shipboard Mechanical Equipment	57
15	Identifying Shipboard Mechanical Equipment Problems	59
16	Engineering Assessment of System/Equipment Reliability	61
17	Structural Design Analysis	63
18	Failure Analysis by Engineering Investigation	65
19	Failure Analysis by Laboratory Testing	67
20	Fault Isolation Procedure Analysis	69
21	Maintainability Prediction (of Mechanical Shipboard Equipments) by Regression	71
22	Maintainability Demonstration Test Planning	73

<u>Item</u>	<u>Title</u>	<u>Page</u>
23	Maintainability Demonstration Testing	75
24	LO-MIX Maintenance Engineering Analysis (LMMEA) Technique	77
25	Maintenance History Analysis of Propulsion Equipment	79
26	Analysis of Corrective Maintenance Resource Consumption	81
27	Engineering Assessment of System/Equipment Maintainability	83
28	Analyzing Shipboard Mechanical Equipment Maintenance and Cost Factors	85
29	Reliability and Maintainability Indices for Shipboard Equipments	89
30	Development of Equipment Behavior Measures	91
31	Analysis of Planned Maintenance System Effectiveness	93
32	Measurement/Assessment of Ship Material Condition (Based on Quantity of Deferred Maintenance)	95
33	Life-Cycle Cost Categorization	99
34	Development of Cost-Estimating Relationships	101
35	Determination of Annualized Maintenance Cost for Ships	103
36	Evaluating Feasibility of Extending Overhaul Interval	105
37	Extended Operating Cycle Program Planning	107
38	Extended Operating Cycle Systems Analysis	109
39	Class-Level Critical Equipment List Development	111
40	Ship Class Baseline Repair Profile Development	113
41	Preparation of Technical Repair Standards	115
42	Management Plan for Use in LOE Preparation	117
43	PEB/LOE Preparation Program	119
44	Pre-Overhaul Training of Ship Personnel	121
45	Shipcheck Planning	123
46	ROH Advance Planning Using Network of Significant Activities/Milestones	125
47	Pre-Overhaul Test and Inspection Procedure	127

<u>Item</u>	<u>Title</u>	<u>Page</u>
48	Development of Standardized Work Requests for ATF/ARS Ships	131
49	Scoping and Estimating Ship's Force Regular Overhaul Work	133
50	Estimating Nonindustrial Labor Requirements for Ship's Force During ROH	135
51	Effectiveness Analysis of Ship Regular Overhaul	139
52	Economic Analysis of Ship Regular Overhaul	141
53	EMC/EMI Instruction	145
54	EMI-Susceptibility Evaluation	147
55	Logistics Management Information System	149
56	Logistic Management Data Program	151
57	Equipment Procurement Specification Development	153
58	Conduct of Shipboard Habitability Survey	155
59	Development of Habitability Improvement Plans for Ships/Classes	159
60	Determination of Spare Parts Inventory for Weapon System	161
61	Logistic Support Planning for Ship Class	163
62	Specific Operational Requirement Review	165
63	Analysis of Relationships Between Mission Requirements and ROH Cycle	167

TECHNIQUE DESCRIPTION SHEET

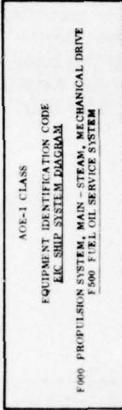
1. Item No.	2. Title			
1	Development of Ship Systems Definition and Index for Ship Classes Using Equipment Identification Code			
3. Description				
<p>A procedure for developing a Ship Systems Definition and Index (SSDI) using the Equipment Identification Code (EIC) as a baseline has been developed and applied to certain ship classes (see references). The SSDI is an orderly description of the total ship in terms of its systems, equipments, and key maintenance items. It includes a structured code, narrative description, and graphical illustrations where appropriate, of the ship and its included systems/equipments. The objectives of the SSDI are to expand on the existing EIC, supplement it through added description, and tailor it to individual ship classes. The SSDI format using the EIC baseline is illustrated by the attached figures.</p>				
DESIGN	4. Type of Technique	5. Cost Parameters	6. Effectiveness Parameters	7. Status
	Math Model	Life Cycle	Effectiveness	Concept
	Computer Program	Development	Perf. Capability	Technique Developed, Not Applied
	Engineering Procedure	Procurement	Availability	Technique Applied One Time
	Management Procedure X	Installation	Reliability	Technique Applied Recurrently X
		Maintenance	Maintainability	
		Operation	None	
		Mgt/Tech Service		
		Modification		
		None	X	
APPLICATION	8. Type of System/Equipment	9. Life Cycle Phase	10. Functional Areas Supported	
	Total Ship X	Concept Form.	Configuration Management	
	Hull Structure X	Validation		
	Propulsion X	Development		
	Electric Plant X	Acquisition		
	Command & Surv. X	Operation X		
	Auxiliaries X			
	Outfit/Furnish. X			
Armament X				
11. References (ARINC Research Corporation publications unless otherwise indicated)				
1. AO-143 Class Ship Systems Definition and Index, Pub. W2-D06-TN01, April 1972				
2. ATF-96 Class Ship Systems Definition and Index, Pub. W2-D06-TN05, Aug. 1972				
3. General Ship Class EIC Systems Staging Diagrams, Pub. W2-D06-TN02, Nov. 1972				
4. AOE-1 Class Ship Systems Definition and Index, Pub. W3-D06-TN03, Feb. 1973				
5. Ship Systems Definition and Index for ARS-7 and ARS-38 Class Ships, Pub. 1620-01-1-1290, March 1974				

Continued

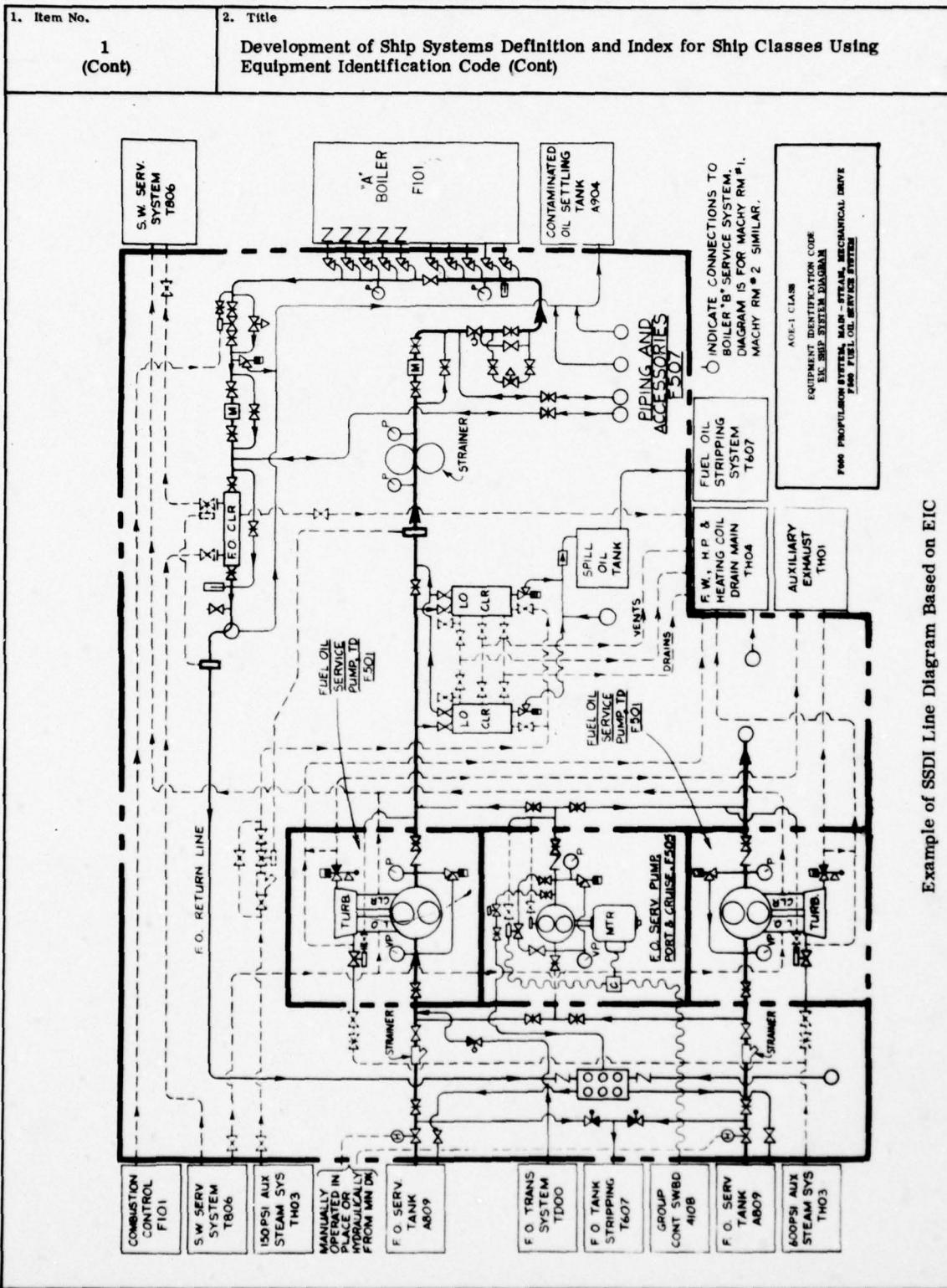
TECHNIQUE DESCRIPTION SHEET

1. Item No.	2. Title
1 (Cont)	<p>Development of Ship Systems Definition and Index for Ship Classes Using Equipment Identification Code (Cont)</p> <pre> graph TD A["F500 MAIN PROPELLION SYSTEM"] --> B["F500 FUEL OIL SERVICE SYSTEM, MAIN PROPELLION"] B --> C["F500 PUMP UNIT, ROTARY, METRON F.O. SERVICE SYSTEM"] C --> D["F500 MAIN FUEL OIL SYSTEM"] </pre> <p>Key Maintenance Items:</p> <ul style="list-style-type: none"> Pump Turbo Generators Gauge <p>Key Maintenance Items:</p> <ul style="list-style-type: none"> Fuel Oil Heaters Fuel Oil Piping Valves Fuel Oil Service Motors Fuel Oil Strainers F.O. Pressure Regulating Valves <p>Definitions:</p> <ul style="list-style-type: none"> Includes Fuel Oil Service Pumps, Piping, and all Accessories up to and including Fuel Oil Service Take up to and including Oil Supply Headers at Boilers. Does Not Include Contaminated Oil Tanks, F.O. Service Take, or Motor, Air, or F.O. Transfer System (TDS). Includes Fuel Oil Service Pumps, Motors, Driven Strainers, Drain Pots, Gauges, Thermometers, Valves, Strainers, Regulating Valves, Piping, and Piping from First External Flange of Fuel Oil Service Take up to and including Fuel Oil Supply Headers. Does Not Include Fuel Oil Service Take or Contaminated Oil Take (See A60). Includes Fuel Oil Service Pumps and Associated Piping, Turbine Generators, Lubricating Oil System, Lubricating Oil Pumps, Piping, and Valves, and Accessories Attached to Units up to First External Flange or Fitting. Does Not Include Foundations (See A70).
Continued	

Example of SSDI System Diagram Based on EIC



TECHNIQUE DESCRIPTION SHEET



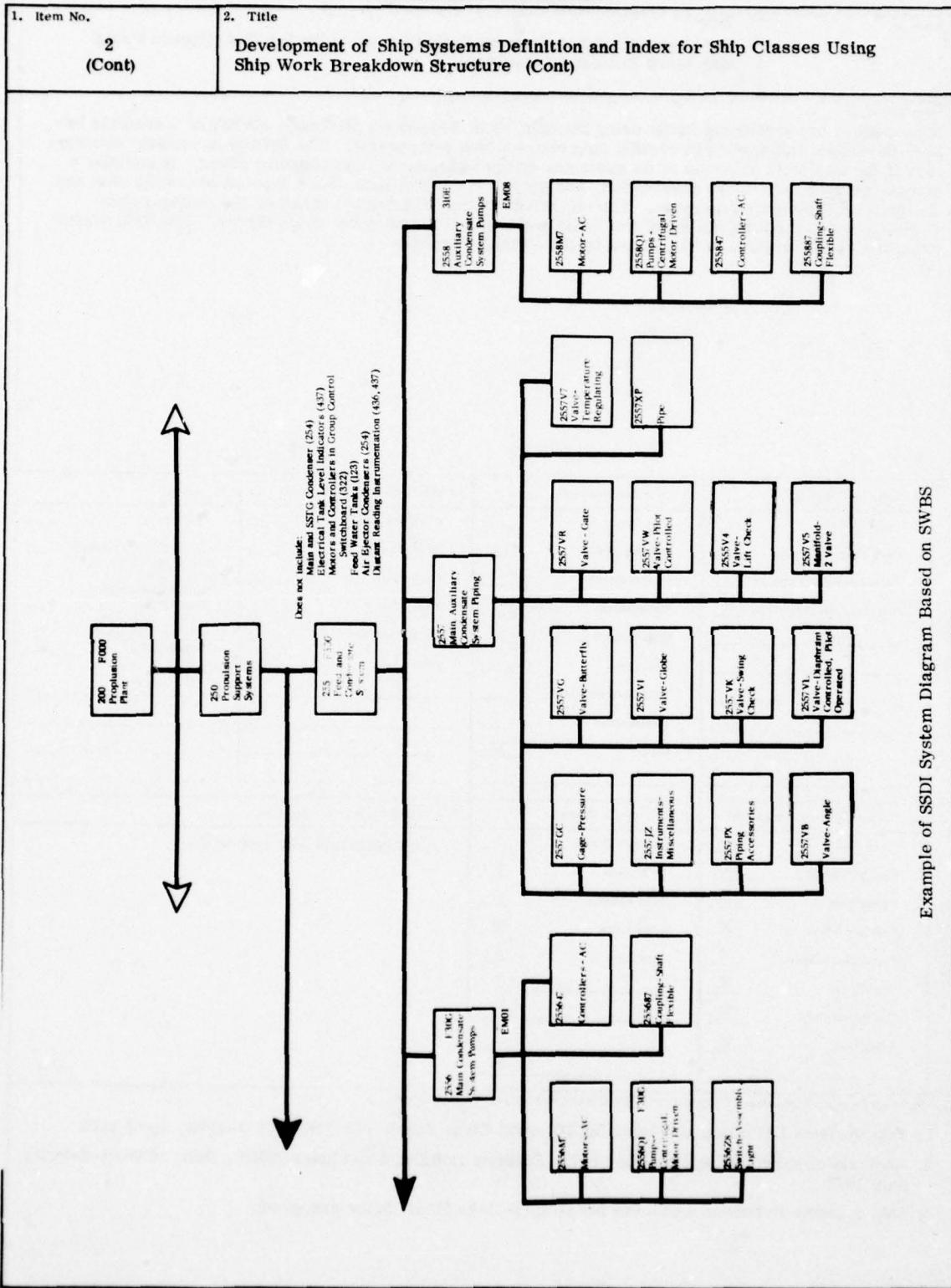
Example of SSDI Line Diagram Based on EIC

TECHNIQUE DESCRIPTION SHEET

1. Item No.	2. Title Development of Ship Systems Definition and Index for Ship Classes Using Ship Work Breakdown Structure			
3. Description A procedure for developing SSDIs using the Ship Work Breakdown Structure (SWBS) as a baseline has been developed and applied to certain ship classes (see references). The SSDI is an orderly description of the total ship in terms of its systems, equipments and key maintenance items. It includes a structured code, narrative description, and graphical illustrations where appropriate of the ship and its included systems/equipments. The objectives of the SSDI are to expand on the configuration visibility and control capability of the SWBS and tailor it to individual ship classes. The SSDI format using the SWBS baseline is illustrated by the attached figures.				
DESIGN	4. Type of Technique	5. Cost Parameters	6. Effectiveness Parameters	7. Status
	Math Model	Life Cycle	Effectiveness	Concept
	Computer Program	Development	Perf. Capability	Technique Developed, Not Applied
	Engineering Procedure	Procurement	Availability	
	Management Procedure X	Installation	Reliability	Technique Applied One Time
		Maintenance	Maintainability	Technique Applied Recurrently X
		Operation	None	
		Mgt/Tech Service		
		Modification		
		None	X	
APPLICATION	8. Type of System/Equipment	9. Life Cycle Phase	10. Functional Areas Supported	
	Total Ship X	Concept Form.	Configuration Management	
	Hull Structure X	Validation	P	
	Propulsion X	Development	P	
	Electric Plant X	Acquisition	P	
	Command & Surv. X	Operation	X	
	Auxiliaries X			
	Outfit/Furnish. X			
Armament X				
11. References (ARINC Research Corporation publications unless otherwise indicated)				
<ol style="list-style-type: none"> 1. Ship Systems Definition and Index for DE-1052 Class Ships, Pub. 1630-01-1-1389, April 1975 2. Analysis of Expanded Application of Ship Systems Definition and Index (SSDI), Pub. 1630-01-2-1428, July 1975 3. Ship Systems Definition and Index for DDG-2 Class Ships (being prepared) 				

Continued

TECHNIQUE DESCRIPTION SHEET



Example of SSDI System Diagram Based on SWBS

Continued

TECHNIQUE DESCRIPTION SHEET

1. Item No. 2 (Cont)

2. Title Development of Ship Systems Definition and Index for Ship Classes Using Ship Work Breakdown Structure (Cont)

Example of SSDI Line Diagram Based on SWBS

TECHNIQUE DESCRIPTION SHEET

1. Item No.	2. Title Communication Electronics Systems Configuration Management Analysis			
3				
3. Description <p>This technique provides for identifying, acquiring, analyzing and reducing the data necessary to generate management planning aids for communication-shipalt configuration management planning. The aids resulting from the process provide visibility regarding shipalt requirements, shipalt completion status, and onboard configuration for all ships of a given class. The technique has been applied to all types of Service Force ships in the Pacific Fleet. The technique can be applied to the electronics suite of any type of ship. Its application is illustrated in the following figure.</p>				
DESIGN	4. Type of Technique	5. Cost Parameters	6. Effectiveness Parameters	7. Status
	Math Model	Life Cycle	Effectiveness	Concept
	Computer Program	Development	Perf. Capability	Technique Developed, Not Applied
	Engineering Procedure X	Procurement	Availability	
	Management Procedure X	Installation	Reliability	Technique Applied One Time
		Maintenance	Maintainability	
		Operation	None	X
		Mgt/Tech Service		
		Modification		
		None	X	
APPLICATION	8. Type of System/Equipment	9. Life Cycle Phase	10. Functional Areas Supported	
	Total Ship	Concept Form.	Configuration Management	
	Hull Structure	Validation	ROH Planning	
	Propulsion	Development	Fleet Modernization Program	
	Electric Plant	Acquisition		
	Command & Surv. X	Operation	X	
	Auxiliaries			
	Outfit/Furnish.			
	Armament			
Service Ships X				
11. References (ARINC Research Corporation publications unless otherwise indicated)				
<ol style="list-style-type: none"> 1. Communication Electronics Systems Configuration Management Analysis for COMSERVPAC Ships, Pub. 1606-01-1-1288, Feb. 1974 2. Shipboard Electronic System Configuration Management Analysis, Pub. 1627-01-4-1412, June 1975 				

Continued

TECHNIQUE DESCRIPTION SHEET

Typical Results of Communication Electronics System Configuration Management Analysis

TECHNIQUE DESCRIPTION SHEET

1. Item No.	2. Title Comparative Analysis of Shipboard Electronic Test Equipment Requirements and Allowances				
4					
3. Description <p>This technique involves determining test equipment requirements and allowances, tabulating these data, and analyzing the information to identify anomalies and provide recommendations concerning a ship's electronic test equipment suite. The technique has been applied to a sampling of Service Force ships, as described in ref. 1. The technique is applicable to the analysis of the electronic test equipment suite for any type of ship. Its application is illustrated in the following figure.</p>					
DESIGN	4. Type of Technique	5. Cost Parameters	6. Effectiveness Parameters	7. Status	
	Math Model	Life Cycle	Effectiveness	Concept	
	Computer Program	P	Development	Technique Developed, Not Applied	
	Engineering Procedure	X	Procurement	Technique Applied One Time	
	Management Procedure	—	Installation	Technique Applied Recurrently	
	—	—	Maintenance	X	
	—	—	Operation	—	
	—	—	Mgt/Tech Service	—	
	—	—	Modification	—	
	—	—	None	X	
APPLICATION	8. Type of System/Equipment	9. Life Cycle Phase	10. Functional Areas Supported		
	Total Ship	Concept Form.	Planned Maintenance System Configuration Management Electronic Test Equipment		
	Hull Structure	Validation	—		
	Propulsion	Development	—		
	Electric Plant	Acquisition	P	—	
	Command & Surv.	Operation	X	—	
	Auxiliaries	—	—		—
	Outfit/Furnish.	—	—		—
	Armament	—	—		—
Test Equip.	X	—		—	
11. References (ARINC Research Corporation publications unless otherwise indicated)					
1. Adequacy and Availability of General Purpose Electronic Test Equipment Aboard ARS, ATF and ATS Class Ships, Pub. 1627-01-1-1409, Vol. I, June 1975					

Continued

TECHNIQUE DESCRIPTION SHEET

1. Item No. 4 (Cont)	2. Title Comparative Analysis of Shipboard Electronic Test Equipment Requirements and Allowances (Cont)
<div style="border: 1px solid black; padding: 5px; margin-top: 10px;"> PRIME ELECTRONIC EQUIPMENT VS. GPETE SCAT FOR USS GRASP (ARS-24) (Matrix I, Sheet 1 of 3) </div> <div style="margin-top: 10px;"> LEGEND: <ul style="list-style-type: none"> ● Unit maintenance requirement from NAVSEA 0967-LP-008-9000 ○ Unit allowance authorization established in NAVFLEX COSAL Part II, Group II, Section A ◇ Unit requirement from 3M maintenance requirement card (MRC) </div>	

Typical Results of Technique Application

TECHNIQUE DESCRIPTION SHEET

1. Item No.	2. Title Validation of Shipalt Status and Applicability		
5			
<p>3. Description</p> <p>This technique comprises a procedure and guidelines for determining/validating the applicability and status of approved ship alterations. Associated steps are:</p> <ul style="list-style-type: none"> a. Review/analyze existing records/data as necessary to summarize known shipalt applicability and status. b. Identify unknown status/applicability factors. c. Compile validation work package. d. Conduct validation shipcheck. 			
DESIGN	4. Type of Technique	5. Cost Parameters	6. Effectiveness Parameters
	Math Model	Life Cycle	Effectiveness
	Computer Program	Development	Perf. Capability <input checked="" type="checkbox"/>
	Engineering Procedure	Procurement	Availability
	Management Procedure <input checked="" type="checkbox"/>	Installation	Reliability
		Maintenance	Maintainability
		Operation	None
		Mgt/Tech Service	
		Modification	
		None <input checked="" type="checkbox"/>	
APPLICATION	8. Type of System/Equipment	9. Life Cycle Phase	10. Functional Areas Supported
	Total Ship <input checked="" type="checkbox"/>	Concept Form.	Configuration Management
	Hull Structure	Validation	ROH Planning
	Propulsion	Development	Fleet Modernization Program
	Electric Plant	Acquisition	
	Command & Surv.	Operation <input checked="" type="checkbox"/>	
	Auxiliaries		
	Outfit/Furnish.		
Armament			
<p>11. References (ARINC Research Corporation publications unless otherwise indicated)</p> <p>1. FMP and Shipalt Validation Packages for USS NEOSHO (AO-143) and Other AO-Type Ships (copies available from Ships & Ordnance Division)</p>			

TECHNIQUE DESCRIPTION SHEET

1. Item No.	2. Title			
6	Evaluation of Engineering Change Proposals			
3. Description				
<p>This procedure involves the engineering analysis necessary to evaluate engineering change proposals (ECPs) for specific equipments. The procedure provides a systematic means of approval/disapproval based on such technical factors as reliability, maintainability, and value. The procedure has been applied to a variety of ECPs for a gun mount (see ref. 2).</p>				
DESIGN	4. Type of Technique	5. Cost Parameters	6. Effectiveness Parameters	7. Status
	Math Model	Life Cycle	Effectiveness	Concept
	Computer Program	Development	Perf. Capability	X
	Engineering Procedure X	Procurement	Availability	—
	Management Procedure	Installation	Reliability	X
	—————	Maintenance	Maintainability	X
	—————	Operation	None	—
	—————	Mgt/Tech Service	—————	—
	—————	Modification	—————	—
	—————	None	—————	—
APPLICATION	8. Type of System/Equipment	9. Life Cycle Phase	10. Functional Areas Supported	
	Total Ship P	Concept Form.	Maintenance Engineering Analysis Configuration Management	
	Hull Structure P	Validation	—	
	Propulsion P	Development	—	
	Electric Plant P	Acquisition	P	
	Command & Surv. P	Operation	X	
	Auxiliaries P	—————	—	
	Outfit/Furnish. P	—————	—	
Armament X	—————	—		
11. References (ARINC Research Corporation publications unless otherwise indicated)				
<ol style="list-style-type: none"> 1. MIL-STD-480, Configuration Control – Engineering Changes, Deviations and Waivers 2. Evaluation of ECPs for the 5"/54 Caliber Mark 45 MOD 0 Gun Mount, Pub. 0978-39-8-1248, June 1973 				

TECHNIQUE DESCRIPTION SHEET

1. Item No.	2. Title			
7	Reliability Prediction (of Mechanical Shipboard Equipments) by Regression			
3. Description				
<p>This technique provides for the development of reliability prediction equations for shipboard mechanical equipments such as pumps, valves, turbines, motor-generator sets, diesel engines, etc. The equations are based on regression analysis involving operational and design parameters such as operating pressures, operating temperatures, number/type of bearings, etc. The prediction equations were based on data from several ship types (see ref. 5). Reliability indices covered in this technique include mean time between failures (MTBF) and mean time between maintenance (MTBM).</p>				
DESIGN	4. Type of Technique	5. Cost Parameters	6. Effectiveness Parameters	7. Status
	Math Model <input checked="" type="checkbox"/>	Life Cycle <input type="checkbox"/>	Effectiveness <input type="checkbox"/>	Concept <input type="checkbox"/>
	Computer Program <input type="checkbox"/>	Development <input type="checkbox"/>	Perf. Capability <input type="checkbox"/>	Technique Developed, Not Applied <input type="checkbox"/>
	Engineering Procedure <input type="checkbox"/>	Procurement <input type="checkbox"/>	Availability <input type="checkbox"/>	<input type="checkbox"/>
	Management Procedure <input type="checkbox"/>	Installation <input type="checkbox"/>	Reliability <input checked="" type="checkbox"/>	Technique Applied One Time <input type="checkbox"/>
	<u>Regression</u> <input type="checkbox"/>	Maintenance <input type="checkbox"/>	Maintainability <input type="checkbox"/>	<input type="checkbox"/>
	<u>Analysis</u> <input checked="" type="checkbox"/>	Operation <input type="checkbox"/>	None <input type="checkbox"/>	Technique Applied Recurrently <input checked="" type="checkbox"/>
	<input type="checkbox"/>	Mgt/Tech Service <input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
	<input type="checkbox"/>	Modification <input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
	<input type="checkbox"/>	None <input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
APPLICATION	8. Type of System/Equipment	9. Life Cycle Phase	10. Functional Areas Supported	
	Total Ship <input type="checkbox"/>	Concept Form. <input checked="" type="checkbox"/>	Reliability Prediction	
	Hull Structure <input type="checkbox"/>	Validation <input checked="" type="checkbox"/>	<input type="checkbox"/>	
	Propulsion <input checked="" type="checkbox"/>	Development <input checked="" type="checkbox"/>	<input type="checkbox"/>	
	Electric Plant <input checked="" type="checkbox"/>	Acquisition <input checked="" type="checkbox"/>	<input type="checkbox"/>	
	Command & Surv. <input checked="" type="checkbox"/>	Operation <input checked="" type="checkbox"/>	<input type="checkbox"/>	
	Auxiliaries <input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
	Outfit/Furnish. <input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
Armament <input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>		
11. References (ARINC Research Corporation publications unless otherwise indicated)				
<ol style="list-style-type: none"> 1. A Technique for Design Prediction of Reliability and Maintainability of Mechanical Equipments, Pub. 594-01-4-962, April 1969 2. Interim Report, Literature Search for Available Reliability Prediction Techniques for Mechanical Equipments, Pub. 933-01-1-1018, Nov. 1969 3. Reliability Prediction for Ship's Machinery, Pub. 4711-1082, Oct. 1970 4. Development of a Reliability Prediction Procedure for Shipboard Mechanical Equipments, Pub. 933-01-2-1079, Nov. 1970 5. Development of a Reliability Prediction Procedure for Shipboard Mechanical Equipments, Pub. 933-02-3-1153, Dec. 1971 				

TECHNIQUE DESCRIPTION SHEET

1. Item No.	2. Title			
8	Reliability Prediction by Summation of Failure Rates			
3. Description				
<p>Reliability prediction by summation of failure rates essentially involves developing a reliability block diagram, determining the population of parts, summing the part failure rates (as determined from a common source such as MIL-HDBK-217A or FARADA), and calculating the reliability of the system/equipment, based on the block diagram. This technique, described basically in MIL-STD-756, has been applied to certain armament and electronic systems (see ref. 2 through 4).</p>				
DESIGN	4. Type of Technique	5. Cost Parameters	6. Effectiveness Parameters	7. Status
	Math Model <input checked="" type="checkbox"/>	Life Cycle <input type="checkbox"/>	Effectiveness <input type="checkbox"/>	Concept <input type="checkbox"/>
	Computer Program <input type="checkbox"/>	Development <input type="checkbox"/>	Perf. Capability <input type="checkbox"/>	Technique Developed, Not Applied <input type="checkbox"/>
	Engineering Procedure <input checked="" type="checkbox"/>	Procurement <input type="checkbox"/>	Availability <input type="checkbox"/>	Technique Applied One Time <input type="checkbox"/>
	Management Procedure <input type="checkbox"/>	Installation <input type="checkbox"/>	Reliability <input checked="" type="checkbox"/>	Technique Applied Recurrently <input checked="" type="checkbox"/>
	<input type="checkbox"/>	Maintenance <input type="checkbox"/>	Maintainability <input type="checkbox"/>	<input type="checkbox"/>
	<input type="checkbox"/>	Operation <input type="checkbox"/>	None <input type="checkbox"/>	<input type="checkbox"/>
	<input type="checkbox"/>	Mgt/Tech Service <input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
	<input type="checkbox"/>	Modification <input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
APPLICATION	8. Type of System/Equipment	9. Life Cycle Phase	10. Functional Areas Supported	
	Total Ship <input type="checkbox"/>	Concept Form. <input checked="" type="checkbox"/>	Reliability Prediction	
	Hull Structure <input type="checkbox"/>	Validation <input checked="" type="checkbox"/>	<input type="checkbox"/>	
	Propulsion <input type="checkbox"/>	Development <input checked="" type="checkbox"/>	<input type="checkbox"/>	
	Electric Plant <input type="checkbox"/>	Acquisition <input checked="" type="checkbox"/>	<input type="checkbox"/>	
	Command & Surv. <input checked="" type="checkbox"/>	Operation <input checked="" type="checkbox"/>	<input type="checkbox"/>	
	Auxiliaries <input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
	Outfit/Furnish. <input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
Armament <input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>		
11. References (ARINC Research Corporation publications unless otherwise indicated)				
<ol style="list-style-type: none"> 1. MIL-STD-756, Reliability Prediction 2. Reliability Prediction for Electrical and Electronic Control Circuitry of the MK 42 MOD 10 Gun Mount, Pub. 978-01-1-1129, Aug. 1971 3. Reliability Prediction for the Electrical and Electronic Control Circuitry of the MK 45 MOD 0 Gun Mount, Pub. 978-02-2-1168, March 1972 4. Initial Reliability Prediction, Remote Unmanned Work System, Pub. D16-16-1-1228, April 1973 				

TECHNIQUE DESCRIPTION SHEET

1. Item No.	2. Title			
9	Reliability Demonstration Test Conduct			
3. Description				
<p>Reliability demonstration test planning is the preparing of a plan that details the methods, procedures, schedule, and description of facilities essential to the conduct of a reliability demonstration test. The technique includes stipulation of accept/reject/continue criteria as stipulated in MIL-STD-781B.</p>				
DESIGN	4. Type of Technique	5. Cost Parameters	6. Effectiveness Parameters	7. Status
	Math Model	Life Cycle	Effectiveness	Concept
	Computer Program	Development	Perf. Capability	Technique Developed, Not Applied
	Engineering Procedure X	Procurement	Availability	Technique Applied One Time X
	Management Procedure	Installation	Reliability	Technique Applied Recurrently
		Maintenance	Maintainability	
		Operation	None	
		Mgt/Tech Service		
		Modification		
		None	X	
APPLICATION	8. Type of System/Equipment	9. Life Cycle Phase	10. Functional Areas Supported	
	Total Ship	Concept Form.	Testing	
	Hull Structure	Validation	Reliability Demonstration	
	Propulsion P	Development		
	Electric Plant P	Acquisition	X	
	Command & Surv. P	Operation		
	Auxillaries P			
	Outfit/Furnish. P			
Armament X				
11. References (ARINC Research Corporation publications unless otherwise indicated)				
1. MIL-STD-781B, Reliability Tests: Exponential Distribution 2. Reliability Demonstration Test Plan for the Weapon Control and Setting Subsystem of the Underwater Fire Control System MK 116 Mod 1, Ltr. SDSO-74-115, Encl. (1), May 31 1974				

TECHNIQUE DESCRIPTION SHEET

1. Item No.	2. Title			
10	Reliability Demonstration Test Conduct			
3. Description				
<p>The technique consists of conducting tests, collecting and analyzing test data, and reporting test results as necessary to evaluate the results of a reliability demonstration test for electronics equipment. The general approach, as described in ref. 1, is applicable to any type of system/equipment for which a reliability demonstration test is conducted.</p>				
DESIGN	4. Type of Technique	5. Cost Parameters	6. Effectiveness Parameters	7. Status
	Math Model	Life Cycle	Effectiveness	Concept
	Computer Program	Development	Perf. Capability	Technique Developed, Not Applied
	Engineering Procedure	Procurement	Availability	
	Management Procedure	Installation	Reliability	Technique Applied One Time X
		Maintenance	Maintainability	Technique Applied Recurrently
		Operation	None	
		Mgt/Tech Service		
		Modification		
		None	X	
APPLICATION	8. Type of System/Equipment	9. Life Cycle Phase	10. Functional Areas Supported	
	Total Ship	Concept Form.	Testing Reliability Demonstration	
	Hull Structure	Validation		
	Propulsion	P Development		
	Electric Plant	P Acquisition		
	Command & Surv.	P Operation		
	Auxiliaries	P		
	Outfit/Furnish.	P		
Armament	X			
11. References (ARINC Research Corporation publications unless otherwise indicated)				
1. Reliability and Maintainability Demonstration Testing of Weapon Control and Setting Subsystem of Underwater Fire Control System Mk 116 Mod 1, Pub. 1616-08-2-1328, Oct. 1974				

TECHNIQUE DESCRIPTION SHEET

1. Item No.	2. Title			
11	Determining Shipboard System Figures of Merit			
3. Description				
<p>This procedure establishes a methodology for determining figures of merit appropriate to the reliability, maintainability, and cost-effectiveness analysis of shipboard systems. The procedure addresses:</p> <ul style="list-style-type: none"> a. The defining of equipment and its sublevels b. Identification and definition of the figures of merit c. Identification of the data elements and sources d. Establishment of computation procedures. <p>The procedure is described in ref. 1. It has been applied to a variety of propulsion system equipments aboard DLG-type ships (see ref. 2).</p>				
DESIGN	4. Type of Technique	5. Cost Parameters	6. Effectiveness Parameters	7. Status
	Math Model <input checked="" type="checkbox"/>	Life Cycle	Effectiveness	Concept
	Computer Program <input type="checkbox"/>	Development	Perf. Capability	Technique Developed, Not Applied
	Engineering Procedure <input checked="" type="checkbox"/>	Procurement	Availability	Technique Applied One Time
	Management Procedure <input type="checkbox"/>	Installation	Reliability	Technique Applied Recurrently
	<input type="checkbox"/>	Maintenance	Maintainability	<input checked="" type="checkbox"/>
	<input type="checkbox"/>	Operation	None	<input type="checkbox"/>
	<input type="checkbox"/>	Mgt/Tech Service	<input type="checkbox"/>	<input type="checkbox"/>
	<input type="checkbox"/>	Modification	<input type="checkbox"/>	<input type="checkbox"/>
	<input type="checkbox"/>	None	<input type="checkbox"/>	<input type="checkbox"/>
APPLICATION	8. Type of System/Equipment	9. Life Cycle Phase	10. Functional Areas Supported	
	Total Ship <input type="checkbox"/>	Concept Form.	Reliability Measurement	
	Hull Structure <input type="checkbox"/>	Validation	Maintainability Measurement	
	Propulsion <input checked="" type="checkbox"/>	Development	Reliability Prediction	
	Electric Plant <input type="checkbox"/> P	Acquisition	Maintainability Prediction	
	Command & Surv. <input type="checkbox"/> P	Operation	Maintenance Engineering Analysis	
	Auxiliaries <input type="checkbox"/> P	<input type="checkbox"/>	Reliability Engineering Analysis	
	Outfit/Furnish. <input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
Armament <input type="checkbox"/> P	<input type="checkbox"/>	<input type="checkbox"/>		
11. References (ARINC Research Corporation publications unless otherwise indicated)				
<ol style="list-style-type: none"> 1. Procedural Techniques for Analysis of Historical Maintenance Data Relating to Shipboard Mechanical Equipments, Pub. 594-01-1-959, April 1969 (Ch. 2) 2. Reliability and Maintainability Analysis of Selected Mechanical Equipments, Pub. 594-01-2-960, April 1969 				

TECHNIQUE DESCRIPTION SHEET

1. Item No.	2. Title				
12	Reliability Program Surveillance				
3. Description					
<p>Reliability program surveillance is the review and analysis of a contractor's reliability program activity as necessary to evaluate his reliability program, including the program plan, reliability predictions, failure mode and effects analyses, and other elements prescribed in MIL-STD-785.</p>					
DESIGN	4. Type of Technique	5. Cost Parameters	6. Effectiveness Parameters	7. Status	
	Math Model	Life Cycle	Effectiveness	Concept	
	Computer Program	Development	Perf. Capability	Technique Developed, Not Applied	
	Engineering Procedure X	Procurement	Availability		
	Management Procedure	Installation	Reliability	X Technique Applied One Time	
		Maintenance	Maintainability		
		Operation	None		
		Mgt/Tech Service			
		Modification			
		None	X		
APPLICATION	8. Type of System/Equipment	9. Life Cycle Phase	10. Functional Areas Supported		
	Total Ship	P	Concept Form.	Reliability Program Evaluation	
	Hull Structure	P	Validation		
	Propulsion	P	Development		
	Electric Plant	P	Acquisition		
	Command & Surv.	P	Operation		
	Auxiliaries	P			
	Outfit/Furnish.	P			
Armament	X				
11. References (ARINC Research Corporation publications unless otherwise indicated)					
<ol style="list-style-type: none"> 1. MIL-STD-785A, Reliability Program for Systems and Equipment Development and Production 2. Results of Reliability Program Surveillance of AN/SSQ-50 Sonobuoy Product Improvement Program Through Acceptance of First Production Lot, Pub. OE08-01-2-1279, December 1973 3. Final Summary Report-Reliability Program Surveillance of AN/SSQ-50 Sonobuoy Product Improvement Production Program (Lots 1 through 8), Pub. 1135-01-1-1355, January 1975 					

TECHNIQUE DESCRIPTION SHEET

1. Item No.	2. Title				
13	Establishment of Mechanical Parts Data Bank				
3. Description					
<p>This procedure encompasses the steps required in formulating a data bank covering shipboard mechanical equipment parts. The procedure includes the steps associated with establishing data bank objectives; identifying data sources; and collecting, processing, and analyzing the data. Potential data sources are identified in the references.</p>					
DESIGN	4. Type of Technique		5. Cost Parameters	6. Effectiveness Parameters	7. Status
	Math Model		Life Cycle	Effectiveness	Concept
	Computer Program	X	Development		Technique Developed, Not Applied
	Engineering Procedure		Procurement		
	Management Procedure		Installation		Technique Applied One Time
			Maintenance		
			Operation		Technique Applied Recurrently
			Mgt/Tech Service		
			Modification		
			None	X	
APPLICATION	8. Type of System/Equipment		9. Life Cycle Phase	10. Functional Areas Supported	
	Total Ship	X	Concept Form.	Reliability Engineering Analysis Maintenance Engineering Analysis Reliability Prediction	
	Hull Structure		Validation		
	Propulsion		Development	X	
	Electric Plant		Acquisition		
	Command & Surv.		Operation	X	
	Auxiliaries				
	Outfit/Furnish.				
	Armament				
11. References (ARINC Research Corporation publications unless otherwise indicated)					
1. Reliability and Maintainability Data-Source Guide, Pub. 527-10-9-725, Jan. 1967					
2. Shipboard Mechanical-Part Failure Rates: Data Sources and Technique for Establishing a Failure Rate Data Bank, Pub. 594-01-3-961, April 1969					

TECHNIQUE DESCRIPTION SHEET

1. Item No.	2. Title			
14	Data Collection and Analysis of Shipboard Mechanical Equipment			
3. Description <p>This procedure covers the collection and processing of MDCS and other data as necessary to compute reliability and maintainability figures of merit for shipboard mechanical systems. The procedure, as illustrated in the attached figure, is described in ref. 1. The procedure has been applied to a variety of shipboard mechanical equipments, as reported in ref. 2.</p>				
DESIGN	4. Type of Technique	5. Cost Parameters	6. Effectiveness Parameters	7. Status
	Math Model	Life Cycle	Effectiveness	Concept
	Computer Program <input checked="" type="checkbox"/>	Development	Perf. Capability	Technique Developed, Not Applied
	Engineering Procedure <input checked="" type="checkbox"/>	Procurement	Availability	Technique Applied One Time
	Management Procedure	Installation	Reliability	Technique Applied Recurrently <input checked="" type="checkbox"/>
		Maintenance	Maintainability	
		Operation	None	
		Mgt/Tech Service		
		Modification		
		None	<input checked="" type="checkbox"/>	
APPLICATION	8. Type of System/Equipment	9. Life Cycle Phase	10. Functional Areas Supported	
	Total Ship	Concept Form.	Reliability Measurement	
	Hull Structure	Validation	Maintainability Measurement	
	Propulsion <input checked="" type="checkbox"/>	Development	Maintenance Cost Analysis	
	Electric Plant <input type="checkbox"/>	Acquisition		
	Command & Surv. <input type="checkbox"/>	Operation <input checked="" type="checkbox"/>		
	Auxiliaries <input type="checkbox"/>			
	Outfit/Furnish. <input type="checkbox"/>			
Armament <input type="checkbox"/>				
11. References (ARINC Research Corporation publications unless otherwise indicated)				
1. Procedural Techniques for Analysis of Historical Maintenance Data Relating to Shipboard Mechanical Equipments, Pub. 594-01-1-959, April 1969 (Ch. 5) 2. Reliability and Maintainability Analysis of Selected Mechanical Equipments, Pub. 594-01-2-960, April 1969 3. Final Report - Pilot Program for Establishment of a Shipboard Machinery Reliability and Maintainability Data Bank, Pub. 588-02-3-1058, May 1970				

Continued

TECHNIQUE DESCRIPTION SHEET

1. Item No.	2. Title
14 (Cont)	Data Collection and Analysis of Shipboard Mechanical Equipment (Cont)
<p style="text-align: center;">Work Flow for Data Collection and Analysis</p>	

TECHNIQUE DESCRIPTION SHEET

1. Item No.	2. Title					
15	Identifying Shipboard Mechanical Equipment Problems					
3. Description						
<p>This procedure provides for combined statistical and engineering analysis of shipboard mechanical systems leading to identification of problems in any of the following areas: design, installation, repair-parts support, documentation, training and manning, support-equipment availability, and cost. The procedure, as described in ref. 1, has been applied to a variety of selected ship propulsion system equipments (see ref. 2).</p>						
DESIGN	4. Type of Technique		5. Cost Parameters	6. Effectiveness Parameters	7. Status	
	Math Model	—	Life Cycle	—	Effectiveness	—
	Computer Program	—	Development	—	Perf. Capability	X
	Engineering Procedure	X	Procurement	—	Availability	—
	Management Procedure	—	Installation	—	Reliability	X
		—	Maintenance	X	Maintainability	X
		—	Operation	—	None	—
		—	Mgt/Tech Service	—		—
		—	Modification	—		—
		—	None	—		—
APPLICATION	8. Type of System/Equipment		9. Life Cycle Phase	10. Functional Areas Supported		
	Total Ship	—	Concept Form.	—	Maintenance Engineering Analysis	
	Hull Structure	—	Validation	—	Reliability Engineering Analysis	
	Propulsion	X	Development	—		
	Electric Plant	P	Aquisition	—		
	Command & Surv.	P	Operation	X		
	Auxiliaries	P		—		
	Outfit/Furnish.	—		—		
Armament	P		—			
11. References (ARINC Research Corporation publications unless otherwise indicated)						
<ol style="list-style-type: none"> 1. Procedural Techniques for Analysis of Historical Maintenance Data Relating to Shipboard Mechanical Equipments, Pub. 594-01-1-959, April 1969 (Ch. 4) 2. Reliability and Maintainability Analysis of Selected Mechanical Equipments, Pub. 594-01-2-960, April 1969 3. Management Analysis Summary of the Toxic Gas Problem in Enclosed Mounts and Turrets, Pub. 0978-21-10-1272, 30 November 1973 						

TECHNIQUE DESCRIPTION SHEET

1. Item No.	2. Title				
16	Engineering Assessment of System/Equipment Reliability				
3. Description					
<p>This technique comprises design/document review, prediction, observation of tests, and related analyses as necessary to assess the reliability of a shipboard system/equipment. Application of this technique to a variety of items is illustrated in the references cited below. The objective of this technique is to assess compliance with stated requirements, identify problems, and provide recommended design, documentation, and procedural changes.</p>					
DESIGN	4. Type of Technique		5. Cost Parameters	6. Effectiveness Parameters	7. Status
	Math Model	—	Life Cycle	Effectiveness	Concept
	Computer Program	—	Development	Perf. Capability	Technique Developed, Not Applied
	Engineering Procedure	X	Procurement	Availability	
	Management Procedure	—	Installation	Reliability	X
		—	Maintenance	Maintainability	
		—	Operation	None	
		—	Mgt./Tech Service		
		—	Modification		
	—	None	X		
APPLICATION	8. Type of System/Equipment		9. Life Cycle Phase	10. Functional Areas Supported	
	Total Ship	—	Concept Form.	Reliability Measurement	
	Hull Structure	—	Validation	Failure Analysis	
	Propulsion	P	Development	Testing	
	Electric Plant	P	Acquisition	Reliability Prediction	
	Command & Surv.	P	Operation		
	Auxiliaries	X			
	Outfit/Furnish.	P			
Armament	X				
11. References (ARINC Research Corporation publications unless otherwise indicated)					
1. Final Report - Reliability Prediction and Assessment Program for Naval Mines (U) (CONFIDENTIAL) Pub. 904-01-1-984, July 1967					
2. An Analysis of the Reliability, Maintainability and Availability of the TAOC in the Military Service Environment, Pub. 555-01-10-874, April 1960					
3. Evaluation of Extending Service Life of Seawater Battery MK 61, MOD 0, Pub. 468-01-1-883, July 1968					

Continued

TECHNIQUE DESCRIPTION SHEET

1. Item No. 16 (Cont)	2. Title Engineering Assessment of System/Equipment Reliability (Cont)
References (Cont)	
<ol style="list-style-type: none">4. Assessment of the Reliability and Maintainability Characteristics of the SSN-594 Class Submarine ASW System, Pub. 574-01-1-907, August 19685. Reliability Assessment of the Mines MK 52 and 55, Mods 1 through 6 (U) (CONFIDENTIAL), Pub. 569-01-1-905, August 19686. Reliability and Maintainability Assessment of the Fast Automatic Shuttle Transfer (FAST) System (Missile Stream), Pub. 589-02-2-971, April 19697. Assessment of the Reliability and Maintainability Characteristics of the SSN-637 Class Submarine ASW System (U) (CONFIDENTIAL), Pub. 901-01-2-1005, Oct. 19698. Users Manual - Data and Computational Procedures for Assessment of the Reliability and Maintainability Characteristics of the SSN-637 Class Submarine ASW System, Pub. 901-01-4-1008, Oct. 19699. Final Report on the Voltage-Transient Tests of the Electrical and Electronic Control Circuitry of the Mark 45 Mod 0 Gun Mount, Pub. 978-03-3-1174, May 197210. Reliability Test of the MK 45 MOD-0 5"/54 Caliber Gun Mounts, Pub. 0978-06-6-1207, Jan. 197311. Analysis of Reliability-Test Results and Practicality of Teardown Inspection for the 5"/54 Caliber MK 42 MOD 7 Gun Mounts, Pub. 978-07-7-1219, March 197312. Engineering Assessment of Coastal Patrol and Interdiction Craft (CPIC) Weapon System, Pub. 1625-01-1-1353, Sept. 197413. A Reliability-Maintainability-Availability Assessment of 3-Inch 50-Caliber Rapid Fire Twin Gun Mounts, Mark 33 Mod 0 and Mod 13, Pub. 1622-02/03-1-1345, Jan. 1975	

TECHNIQUE DESCRIPTION SHEET

1. Item No.	2. Title			
17	Structural Design Analysis			
3. Description				
<p>This technique incorporates the procedures necessary to establish design criteria, perform stress analyses, identify deficiencies, and recommend changes relative to mechanical systems.</p>				
DESIGN	4. Type of Technique	5. Cost Parameters	6. Effectiveness Parameters	7. Status
	Math Model <input checked="" type="checkbox"/>	Life Cycle <input type="checkbox"/>	Effectiveness <input type="checkbox"/>	Concept <input type="checkbox"/>
	Computer Program <input type="checkbox"/>	Development <input type="checkbox"/>	Perf. Capability <input type="checkbox"/>	Technique Developed, <input type="checkbox"/> Not Applied <input type="checkbox"/>
	Engineering Procedure <input checked="" type="checkbox"/>	Procurement <input type="checkbox"/>	Availability <input type="checkbox"/>	<input type="checkbox"/>
	Management Procedure <input type="checkbox"/>	Installation <input type="checkbox"/>	Reliability <input checked="" type="checkbox"/>	Technique Applied One Time <input type="checkbox"/>
	<input type="checkbox"/>	Maintenance <input type="checkbox"/>	Maintainability <input type="checkbox"/>	<input type="checkbox"/>
	<input type="checkbox"/>	Operation <input type="checkbox"/>	None <input type="checkbox"/>	<input type="checkbox"/>
	<input type="checkbox"/>	Mgt/Tech Service <input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
	<input type="checkbox"/>	Modification <input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
	<input type="checkbox"/>	None <input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
APPLICATION	8. Type of System/Equipment	9. Life Cycle Phase	10. Functional Areas Supported	
	Total Ship <input type="checkbox"/>	Concept Form. <input type="checkbox"/>	Structural Design Analysis	
	Hull Structure <input type="checkbox"/>	Validation <input checked="" type="checkbox"/>		
	Propulsion <input type="checkbox"/>	Development <input type="checkbox"/> P		
	Electric Plant <input type="checkbox"/>	Acquisition <input type="checkbox"/> P		
	Command & Surv. <input type="checkbox"/>	Operation <input type="checkbox"/> P		
	Auxiliaries <input type="checkbox"/>	<input type="checkbox"/>		
	Outfit/Furnish. <input type="checkbox"/>	<input type="checkbox"/>		
	Armament <input checked="" type="checkbox"/>	<input type="checkbox"/>		
11. References (ARINC Research Corporation publications unless otherwise indicated)				
1. Design Analysis of Modified Bulk Support Structure in DOT Underwater Light Assembly (12000 and 20000 Feet), Pub. W2-D16-TN03, Oct. 1972				
2. Design Analysis of Work System Package (WSP) for Underwater Applications, Pub. W3-1616-TN02, Nov. 1973				

TECHNIQUE DESCRIPTION SHEET

1. Item No.	2. Title			
18	Failure Analysis by Engineering Investigation			
3. Description				
<p>This technique is that of engineering analysis of equipments that have failed in the field. The approach consists of investigating cause of failure from field data, and analyzing circuitry/operation as necessary to formulate corrective action. The general approach is applicable to any type of equipment.</p>				
DESIGN	4. Type of Technique	5. Cost Parameters	6. Effectiveness Parameters	7. Status
	Math Model	Life Cycle	Effectiveness	Concept
	Computer Program	Development	Perf. Capability	Technique Developed, Not Applied
	Engineering Procedure X	Procurement	Availability	
	Management Procedure	Installation	Reliability	Technique Applied One Time
		Maintenance	Maintainability	Technique Applied Recurrently
		Operation	None	
		Mgt/Tech Service		
		Modification		
APPLICATION	8. Type of System/Equipment	9. Life Cycle Phase	10. Functional Areas Supported	
	Total Ship	Concept Form.	Failure Analysis	
	Hull Structure P	Validation		
	Propulsion P	Development X		
	Electric Plant X	Acquisition X		
	Command & Surv. X	Operation X		
	Auxiliaries P			
	Outfit/Furnish. P			
	Armament X			
11. References (ARINC Research Corporation publications unless otherwise indicated)				
<ol style="list-style-type: none"> 1. Quarterly Status Report #4, MK 46 Torpedo Reliability Data Center Failure Information, Pub. W7-417-TN005-1, Dec. 1967 2. Analysis of Power Distribution and Power Dissipation in the 5"/54 MK 42 MOD 9 and 10 Gun Mounts, Pub. 1621-01-1-1307, July 1974 3. Evaluation of 30 KW and 2.5 KW Generators Used on SERVPAC ARS and ATF Class Ships, Pub. 1620-01-2-1338, Nov. 1974 4. Reliability and Maintainability Assessment of Mobile Submarine Simulator from TECHEVAL Data (U), CONFIDENTIAL, Pub. 1616-10-5-1417, June 1975 5. Reliability and Maintainability Assessment of Mobile Submarine Simulation During Technical Evaluation (U), CONFIDENTIAL, Pub. 1616-18-8-1485, March 1976 				

TECHNIQUE DESCRIPTION SHEET

1. Item No.	2. Title			
19	Failure Analysis by Laboratory Testing			
3. Description				
<p>This technique involves laboratory analysis of equipments that have failed in the field, i.e., testing the equipments, isolating failures as necessary to establish failure mode, and developing recommendations for preventing recurrence. This technique has been applied to various shipboard electronic equipments (see reference) and is generally applicable to any item that can be tested under laboratory conditions.</p>				
DESIGN	4. Type of Technique	5. Cost Parameters	6. Effectiveness Parameters	7. Status
	Math Model	Life Cycle	Effectiveness	Concept
	Computer Program	Development	Perf. Capability	X Technique Developed, Not Applied
	Engineering Procedure	Procurement	Availability	
	Management Procedure	Installation	Reliability	X Technique Applied One Time
		Maintenance	Maintainability	X Technique Applied Recurrently
		Operation	None	
		Mgt/Tech Service		
		Modification		
		None	X	
APPLICATION	8. Type of System/Equipment	9. Life Cycle Phase	10. Functional Areas Supported	
	Total Ship	Concept Form.	Failure Analysis Testing	
	Hull Structure	Validation		
	Propulsion	Development		
	Electric Plant	Acquisition		
	Command & Surv.	Operation	X	
	Auxiliaries			
	Outfit/Furnish.			
Armament				
11. References (ARINC Research Corporation publications unless otherwise indicated)				
1. Analysis of Failed Power Supplies Used in the 5"/54 Caliber MK 42 Gun Mount EP-1 Control Panel, Pub. 0978-23-11-1284, Jan. 1974				

TECHNIQUE DESCRIPTION SHEET

1. Item No.	2. Title			
20	Fault Isolation Procedure Analysis			
3. Description				
<p>Fault isolation procedure analysis encompasses the review of documentation, observation of maintenance practices, and design analysis as necessary to evaluate existing fault isolation procedures. As described in ref. 1, this technique has been applied to the Mk 42 Mod 9 Gun Loading System. Application of the technique may result in design/procedural changes.</p>				
DESIGN	4. Type of Technique	5. Cost Parameters	6. Effectiveness Parameters	7. Status
	Math Model	Life Cycle	Effectiveness	Concept
	Computer Program	Development	Perf. Capability	Technique Developed, Not Applied
	Engineering Procedure X	Procurement	Availability	
	Management Procedure	Installation	Reliability	Technique Applied One Time X
		Maintenance	Maintainability	Technique Applied Recurrently
		Operation	None	
		Mgt/Tech Service		
		Modification		
APPLICATION	8. Type of System/Equipment	9. Life Cycle Phase	10. Functional Areas Supported	
	Total Ship	Concept Form.	Maintenance Engineering Analysis Electrical Design Analysis	
	Hull Structure	Validation		
	Propulsion	Development		
	Electric Plant	Acquisition		
	Command & Surv. P	Operation X		
	Auxiliaries			
	Outfit/Furnish.			
Armament X				
11. References (ARINC Research Corporation publications unless otherwise indicated)				
1. MK 42 Mod 9 Gun Loading System: Fault Isolation Procedure Analysis, Pub. 1621-02-2-1331, Sept. 1974				

TECHNIQUE DESCRIPTION SHEET

1. Item No.	2. Title				
21	Maintainability Prediction (of Mechanical Shipboard Equipments) by Regression				
3. Description					
<p>This technique involves the development of maintainability prediction equations for shipboard mechanical equipments such as pumps, valves and turbines. The equations are based on regression analysis involving operational parameters (e.g., pressure, temperature) and design parameters (e.g., number of bearings). The prediction equations are based upon data from 17 destroyers. The maintainability indices included in the technique include mean time to repair (MTTR) and mean down time (MDT).</p>					
DESIGN	4. Type of Technique		5. Cost Parameters	6. Effectiveness Parameters	7. Status
	Math Model	<input checked="" type="checkbox"/>	Life Cycle	Effectiveness	Concept
	Computer Program	<input type="checkbox"/>	Development	Perf. Capability	Technique Developed, Not Applied
	Engineering Procedure	<input type="checkbox"/>	Procurement	Availability	Technique Applied One Time
	Management Procedure	<input type="checkbox"/>	Installation	Reliability	Technique Applied Recurrently
	Regression	<input type="checkbox"/>	Maintenance	Maintainability	<input checked="" type="checkbox"/>
	Analysis	<input checked="" type="checkbox"/>	Operation	None	<input type="checkbox"/>
		<input type="checkbox"/>	Mgt/Tech Service		<input type="checkbox"/>
		<input type="checkbox"/>	Modification		<input type="checkbox"/>
		<input type="checkbox"/>	None	<input checked="" type="checkbox"/>	<input type="checkbox"/>
APPLICATION	8. Type of System/Equipment		9. Life Cycle Phase	10. Functional Areas Supported	
	Total Ship	<input type="checkbox"/>	Concept Form.	<input checked="" type="checkbox"/>	Maintainability Prediction
	Hull Structure	<input type="checkbox"/>	Validation	<input checked="" type="checkbox"/>	
	Propulsion	<input checked="" type="checkbox"/>	Development	<input checked="" type="checkbox"/>	
	Electric Plant	<input checked="" type="checkbox"/>	Acquisition	<input checked="" type="checkbox"/>	
	Command & Surv.	<input checked="" type="checkbox"/>	Operation	<input checked="" type="checkbox"/>	
	Auxiliaries	<input checked="" type="checkbox"/>			
	Outfit/Furnish.	<input type="checkbox"/>			
Armament	<input checked="" type="checkbox"/>				
11. References (ARINC Research Corporation publications unless otherwise indicated)					
1. A Technique for Design Prediction of Reliability and Maintainability of Mechanical Equipment, Pub. 594-01-4-962, April 1969					

TECHNIQUE DESCRIPTION SHEET

TECHNIQUE DESCRIPTION SHEET

1. Item No. 23	2. Title Maintainability Demonstration Testing			
3. Description The technique includes test monitoring, test-data collection and analysis, and the reporting of test results as necessary to evaluate a maintainability demonstration test. The general approach illustrated by ref. 1 is applicable to any type of system/equipment for which a maintainability demonstration test is conducted.				
DESIGN	4. Type of Technique	5. Cost Parameters	6. Effectiveness Parameters	7. Status
	Math Model	Life Cycle	Effectiveness	Concept
	Computer Program	Development	Perf. Capability	Technique Developed, Not Applied
	Engineering Procedure X	Procurement	Availability	
	Management Procedure	Installation	Reliability	Technique Applied One Time X
		Maintenance	Maintainability X	Technique Applied Recurrently
		Operation	None	
		Mgt/Tech Service		
		Modification		
		None X		
APPLICATION	8. Type of System/Equipment	9. Life Cycle Phase	10. Functional Areas Supported	
	Total Ship	Concept Form.	Testing Maintainability Demonstration	
	Hull Structure	Validation		
	Propulsion P	Development		
	Electric Plant P	Acquisition X		
	Command & Surv. P	Operation		
	Auxiliaries P			
	Outfit/Furnish. P			
Armament X				
11. References (ARINC Research Corporation publications unless otherwise indicated)				
1. Reliability and Maintainability Demonstration Testing of Weapon Control and Setting Subsystem of Underwater Fire Control System, MK 116 Mod 1, Pub. 1616-08-2-1328, Oct. 1974				

TECHNIQUE DESCRIPTION SHEET

1. Item No.	2. Title			
24	LO-MIX Maintenance Engineering Analysis (LMMEA) Technique			
3. Description				
<p>A technique was developed for performing a maintenance engineering analysis of HM&E, ordnance, and electronic equipments on the LO-MIX class of ships in a manner that is less time-consuming and less costly than analyses performed in accordance with MIL-M-24365A (ref. 1).</p> <p>The technique is versatile because it is applicable to equipments for which there are no historical maintenance data, and which have not been subjected to maintenance engineering analysis conforming to MIL-M-24365A. Analyses performed per this technique are compatible with the input requirements of the Trident Integrated Logistic Support System. Under the technique, any one of three classes of analysis can be performed, depending on the nature of the item. The analysis classes are described on the attached sheet.</p>				
DESIGN	4. Type of Technique	5. Cost Parameters	6. Effectiveness Parameters	7. Status
	Math Model	Life Cycle	Effectiveness	Concept
	Computer Program	Development	Perf. Capability	Technique Developed, Not Applied
	Engineering Procedure X	Procurement	Availability	
	Management Procedure	Installation	Reliability	Technique Applied One Time
		Maintenance X	Maintainability X	Technique Applied Recurrently X
		Operation	None	
		Mgt/Tech Service		
		Modification		
	None			
APPLICATION	8. Type of System/Equipment	9. Life Cycle Phase	10. Functional Areas Supported	
	Total Ship	Concept Form.	Maintenance Engineering Analysis	
	Hull Structure	Validation		
	Propulsion X	Development		
	Electric Plant P	Acquisition X		
	Command & Surv. P	Operation		
	Auxiliaries X			
	Outfit/Furnish. P			
Armament X				
11. References (ARINC Research Corporation publications unless otherwise indicated)				
<ol style="list-style-type: none"> 1. MIL-M-24365A, Maintenance Engineering Analysis, Establishment of, and Procedures and Formats for Associated Documentation, General Specification for, July 1970 2. LO-MIX Maintenance Engineering Analysis Technique, Pub. 1616-09-3-1341, Nov. 1974 3. LO-MIX Maintenance Engineering Analysis (LMMEA) Instructions and Forms, Pub. 1616-12-4-1393, June 1975 4. LO-MIX Maintenance Engineering Analysis (LMMEA) Pilot Effort, Pub. 1616-12-5-1418, June 1975 				

Continued

TECHNIQUE DESCRIPTION SHEET

1. Item No.	2. Title
24 (Cont)	LO-MIX Maintenance Engineering Analysis (LMMEA) Technique (Cont)

The Class I LMMEA is reserved for those units undergoing test and development. It is an in-depth analysis of units for which neither a standard MEA nor historical maintenance data are available. The engineer proceeds by collecting all available information in the form of drawings, design specifications, design criteria, and similar sources. This information is analyzed to determine what operating equipments the unit resembles. The operating equipments similar to the unit are analyzed to determine the unit's maintenance engineering requirements. These requirements are entered on the LMMEA Analysis Sheet. The Class I LMMEA is considered a unique class because of the time required for raw-data identification and collection. However, a Class I LMMEA can usually be completed in less than three months.

The Class II LMMEA identifies the maintenance engineering requirements of a lead unit for an equipment group through an in-depth analysis of existing data on the unit. The engineer assembles all identifiable data on the unit, using the LMMEA Analysis Sheet as a guide. If the unit is in the Case I or Case II category of data availability, little more than the standard MEA will be necessary. For units that are in the Case I or Case II category, a Class II LMMEA can be produced in less than two weeks. If the unit is in the Case III category, documents such as technical manuals, drawings, TRSs, APLs, Maintenance History Analyses, MIL-Standards, and others will be required. The LMMEA Analysis Sheet is used as a guide in researching and analyzing the documentation collected, and the data are entered on the LMMEA Analysis Sheet. For units in the Case III category, a Class II LMMEA can be produced in less than three weeks.

The Class III LMMEA is a method of identifying the maintenance engineering requirements of a follow-on unit of an equipment group. The engineer analyzes the requirements identified for the lead unit of that equipment group and relates those requirements to the unit of interest. The documentation required is a description of the unit under consideration and the completed LMMEA for the lead unit of the equipment group to which the unit under consideration belongs. A Class III LMMEA can be produced in less than three days.

TECHNIQUE DESCRIPTION SHEET

1. Item No.	2. Title			
25	Maintenance History Analysis of Propulsion Equipment			
3. Description				
<p>This technique involves the application of a set of MDCS data sort programs designed to support accomplishment of the following analytical process:</p> <ul style="list-style-type: none"> a. Compilation of maintenance event and man-hour history b. Calculation of parts usage frequency c. Identification of malfunction type d. Trend analysis <p>The technique has been applied to selected propulsion system equipments for various destroyer classes (see references). The attached table illustrates typical results from application of the technique. While application to date has been limited to propulsion equipments in destroyers, it generally is applicable to any one type of ship/system for which 3M data are collected.</p>				
DESIGN	4. Type of Technique	5. Cost Parameters	6. Effectiveness Parameters	7. Status
	Math Model <input checked="" type="checkbox"/>	Life Cycle _____	Effectiveness _____	Concept _____
	Computer Program <input checked="" type="checkbox"/>	Development _____	Perf. Capability _____	Technique Developed, Not Applied _____
	Engineering Procedure <input checked="" type="checkbox"/>	Procurement _____	Availability _____	Technique Applied One Time _____
	Management Procedure _____	Installation _____	Reliability <input checked="" type="checkbox"/>	Technique Applied Recurrently <input checked="" type="checkbox"/> _____
	_____	Maintenance <input checked="" type="checkbox"/>	Maintainability <input checked="" type="checkbox"/>	_____
	_____	Operation _____	None _____	_____
	_____	Mgt/Tech Service _____	_____	_____
	_____	Modification _____	_____	_____
	_____	None _____	_____	_____
APPLICATION	8. Type of System/Equipment	9. Life Cycle Phase	10. Functional Areas Supported	
	Total Ship _____	Concept Form. _____	Reliability Trend Analysis	
	Hull Structure _____	Validation _____	Maintainability Trend Analysis	
	Propulsion <input checked="" type="checkbox"/>	Development _____	Reliability Measurement	
	Electric Plant <input checked="" type="checkbox"/>	Acquisition _____	Maintainability Measurement	
	Command & Surv. <input type="checkbox"/>	Operation <input checked="" type="checkbox"/>		
	Auxiliaries <input checked="" type="checkbox"/>	_____		
	Outfit/Furnish. _____	_____		
	Armament <input type="checkbox"/>	_____		
Destroyers <input checked="" type="checkbox"/>	_____			
11. References (ARINC Research Corporation publications unless otherwise indicated)				
<ol style="list-style-type: none"> 1. Maintenance-History Analysis of Main Feed Pump Turbines for DDG-2 Class Ships, Pub. 1012-01-2-1231, Feb. 1973 2. Approach for Development of Maintenance History Analysis for DDG-2 Class Propulsion Equipment, Pub. 1012-01-1-1230, Feb. 1973 3. Data Summary and Results of a Study of Candidate Equipments for Maintenance History Analysis, 1200 PSI Propulsion Equipment for DLG-9 Class Ships, Pub. 1012-01-3-1232, Feb. 1973 				

Continued

TECHNIQUE DESCRIPTION SHEET

1. Item No.	2. Title																																																																																																																																																																																																																																																																																																																			
25 (Cont)	Maintenance History Analysis of Propulsion Equipment (Cont)																																																																																																																																																																																																																																																																																																																			
References (Cont)																																																																																																																																																																																																																																																																																																																				
<p>4. Maintenance-History Analysis for DDG-2 Class Propulsion Equipment, Pub. 1012-01-4-1239, May 1973</p> <p>5. Maintenance History Analysis for DLG-9 Class Propulsion Equipment, Pub. 1117-01-1-1250, July 1973</p>																																																																																																																																																																																																																																																																																																																				
<table border="1" style="width: 100%; border-collapse: collapse; font-size: small;"> <thead> <tr> <th style="text-align: left;">Equipment Name</th> <th style="text-align: center;">Related CID/APL Number(s)</th> <th style="text-align: center;">Number of Equipments</th> <th style="text-align: center;">Total Operating Hours</th> <th style="text-align: center;">Total CM Events</th> <th style="text-align: center;">Total CM Man-Hours</th> <th style="text-align: center;">Average Operating Hours Between CM Events</th> <th style="text-align: center;">Average Man-Hours Per Event</th> <th style="text-align: center;">Average Number of CM Events Per Ship Per Month</th> <th style="text-align: center;">Average CM Man-Hours Per Ship Per Month</th> </tr> </thead> <tbody> <tr> <td>Distillers</td> <td>080100016 080030009</td> <td style="text-align: center;">10 10</td> <td style="text-align: center;">165,762 232,992</td> <td style="text-align: center;">565 696</td> <td style="text-align: center;">9,567.6 14,869.3</td> <td style="text-align: center;">293 335</td> <td style="text-align: center;">16.9 21.5</td> <td style="text-align: center;">1.99 2.04</td> <td style="text-align: center;">33.2 43.8</td> </tr> <tr> <td>Forced Draft Blowers</td> <td>057960005 057960009 057960003 0579600152</td> <td style="text-align: center;">40 8 16 16</td> <td style="text-align: center;">437,344 83,952 198,750 159,792</td> <td style="text-align: center;">813 309 212 182</td> <td style="text-align: center;">16,209.6 5,858.9 1,489.5 1,098.4</td> <td style="text-align: center;">538 272 938 878</td> <td style="text-align: center;">19.9 19.0 7.0 6.0</td> <td style="text-align: center;">2.64 4.29 1.51 1.65</td> <td style="text-align: center;">52.6 81.4 10.6 10.0</td> </tr> <tr> <td>Main Feed Pump</td> <td>016031226 017020014</td> <td style="text-align: center;">18 42</td> <td style="text-align: center;">106,018 333,617</td> <td style="text-align: center;">234 718</td> <td style="text-align: center;">3,190.7 10,307.2</td> <td style="text-align: center;">453 465</td> <td style="text-align: center;">13.6 14.4</td> <td style="text-align: center;">1.31 1.58</td> <td style="text-align: center;">17.9 22.8</td> </tr> <tr> <td>Main Feed Pump Turbine</td> <td>057100043 057260147¹</td> <td style="text-align: center;">18 42</td> <td style="text-align: center;">106,018 333,617</td> <td style="text-align: center;">271 576</td> <td style="text-align: center;">2,973.8 4,658.3</td> <td style="text-align: center;">391 579</td> <td style="text-align: center;">10.9 8.1</td> <td style="text-align: center;">1.52 1.27</td> <td style="text-align: center;">16.7 10.3</td> </tr> <tr> <td>Combustion and Feedwater Control System</td> <td>619510065 619510060</td> <td style="text-align: center;">12 28</td> <td style="text-align: center;">214,764 6,5,074</td> <td style="text-align: center;">219 1,220</td> <td style="text-align: center;">1,626.6 5,544.1</td> <td style="text-align: center;">985 545</td> <td style="text-align: center;">7.4 4.5</td> <td style="text-align: center;">1.23 2.70</td> <td style="text-align: center;">9.1 12.3</td> </tr> <tr> <td>SGT Turbine and Reduction Gear²</td> <td>057150225</td> <td style="text-align: center;">20</td> <td style="text-align: center;">107,493</td> <td style="text-align: center;">90</td> <td style="text-align: center;">1,736.0</td> <td style="text-align: center;">1,194</td> <td style="text-align: center;">19.3</td> <td style="text-align: center;">0.79</td> <td style="text-align: center;">15.2</td> </tr> <tr> <td>High Pressure Turbine</td> <td>051150015, -17, -21 051010074, -75, -76</td> <td style="text-align: center;">10 10</td> <td style="text-align: center;">118,902 183,800</td> <td style="text-align: center;">269 352</td> <td style="text-align: center;">1,692.5 8,594.6</td> <td style="text-align: center;">442 522</td> <td style="text-align: center;">8.3 24.4</td> <td style="text-align: center;">0.93 1.01</td> <td style="text-align: center;">5.9 25.1</td> </tr> <tr> <td>Low Pressure Turbine</td> <td>051150014, -18 051010074, -82, -77</td> <td style="text-align: center;">10 10</td> <td style="text-align: center;">118,902 183,800</td> <td style="text-align: center;">105 92</td> <td style="text-align: center;">1,772.8 3,184.3</td> <td style="text-align: center;">1,132 1,996</td> <td style="text-align: center;">16.9 14.6</td> <td style="text-align: center;">0.36 0.27</td> <td style="text-align: center;">6.2 9.3</td> </tr> <tr> <td>Auxiliary Circulating Pump³</td> <td>016050209</td> <td style="text-align: center;">8</td> <td style="text-align: center;">60,912</td> <td style="text-align: center;">17</td> <td style="text-align: center;">639.0</td> <td style="text-align: center;">3,583</td> <td style="text-align: center;">37.6</td> <td style="text-align: center;">0.33</td> <td style="text-align: center;">12.4</td> </tr> <tr> <td>Auxiliary Condensate Pump³</td> <td>016020978</td> <td style="text-align: center;">8</td> <td style="text-align: center;">107,493</td> <td style="text-align: center;">23</td> <td style="text-align: center;">101.7</td> <td style="text-align: center;">4,674</td> <td style="text-align: center;">4.4</td> <td style="text-align: center;">0.45</td> <td style="text-align: center;">2.0</td> </tr> <tr> <td>Main Feed Booster Pump</td> <td>016000061</td> <td style="text-align: center;">60</td> <td style="text-align: center;">448,717</td> <td style="text-align: center;">800</td> <td style="text-align: center;">11,010.3</td> <td style="text-align: center;">561</td> <td style="text-align: center;">16.3</td> <td style="text-align: center;">1.27</td> <td style="text-align: center;">20.7</td> </tr> <tr> <td>Main Feed Booster Pump Turbine³</td> <td>057950056</td> <td style="text-align: center;">18</td> <td style="text-align: center;">165,076</td> <td style="text-align: center;">238</td> <td style="text-align: center;">3,125.8</td> <td style="text-align: center;">694</td> <td style="text-align: center;">14.0</td> <td style="text-align: center;">0.41</td> <td style="text-align: center;">5.3</td> </tr> <tr> <td>Main Condensate Pump</td> <td>016020495</td> <td style="text-align: center;">40</td> <td style="text-align: center;">457,515</td> <td style="text-align: center;">544</td> <td style="text-align: center;">12,192.3</td> <td style="text-align: center;">841</td> <td style="text-align: center;">22.4</td> <td style="text-align: center;">0.86</td> <td style="text-align: center;">19.4</td> </tr> <tr> <td>Main Condensate Pump Turbine³</td> <td>057950053</td> <td style="text-align: center;">18</td> <td style="text-align: center;">200,730</td> <td style="text-align: center;">383</td> <td style="text-align: center;">5,550.4</td> <td style="text-align: center;">524</td> <td style="text-align: center;">14.5</td> <td style="text-align: center;">0.69</td> <td style="text-align: center;">9.9</td> </tr> <tr> <td>Main Lube Oil Pump⁴</td> <td>016160255 016160325</td> <td style="text-align: center;">40</td> <td style="text-align: center;">426,396</td> <td style="text-align: center;">333</td> <td style="text-align: center;">904.2</td> <td style="text-align: center;">3,280</td> <td style="text-align: center;">7.0</td> <td style="text-align: center;">0.21</td> <td style="text-align: center;">1.4</td> </tr> <tr> <td>016160322</td> <td>20</td> <td style="text-align: center;">136,215</td> <td style="text-align: center;">12</td> <td style="text-align: center;">234.3</td> <td style="text-align: center;">11,151</td> <td style="text-align: center;">19.5</td> <td style="text-align: center;">0.02</td> <td style="text-align: center;">0.4</td> </tr> <tr> <td>016160417⁵</td> <td>20</td> <td style="text-align: center;">136,215</td> <td style="text-align: center;">12</td> <td style="text-align: center;">234.3</td> <td style="text-align: center;">11,151</td> <td style="text-align: center;">19.5</td> <td style="text-align: center;">0.02</td> <td style="text-align: center;">0.4</td> </tr> <tr> <td>Main Lube Oil Pump Turbine³</td> <td>057150137 057150170 057150179</td> <td style="text-align: center;">2 16 2</td> <td style="text-align: center;">275,459</td> <td style="text-align: center;">486</td> <td style="text-align: center;">3,638.1</td> <td style="text-align: center;">567</td> <td style="text-align: center;">7.5</td> <td style="text-align: center;">0.77</td> <td style="text-align: center;">5.8</td> </tr> <tr> <td>Soot Blowers⁶</td> <td>81303028⁷ 81302074 81302075 81302081</td> <td style="text-align: center;">132 56 112 84</td> <td style="text-align: center;">470,190</td> <td style="text-align: center;">506</td> <td style="text-align: center;">5,142.6</td> <td style="text-align: center;">928⁸</td> <td style="text-align: center;">10.2</td> <td style="text-align: center;">0.80</td> <td style="text-align: center;">8.2</td> </tr> <tr> <td>Main Reduction Gear⁹</td> <td>69150039 69150060 69150064 69150094 69150095</td> <td style="text-align: center;">10</td> <td style="text-align: center;">118,902</td> <td style="text-align: center;">109</td> <td style="text-align: center;">599.9</td> <td style="text-align: center;">1,090</td> <td style="text-align: center;">5.5</td> <td style="text-align: center;">0.37</td> <td style="text-align: center;">1.75</td> </tr> <tr> <td>SGT AC Generator¹⁰</td> <td>161140005</td> <td style="text-align: center;">20</td> <td style="text-align: center;">107,493</td> <td style="text-align: center;">20</td> <td style="text-align: center;">280.3</td> <td style="text-align: center;">5,375</td> <td style="text-align: center;">14.0</td> <td style="text-align: center;">0.18</td> <td style="text-align: center;">2.5</td> </tr> <tr> <td>Main Circulating Pump Turbine³</td> <td>057950046</td> <td style="text-align: center;">12</td> <td style="text-align: center;">155,574</td> <td style="text-align: center;">169</td> <td style="text-align: center;">1,916.3</td> <td style="text-align: center;">921</td> <td style="text-align: center;">11.5</td> <td style="text-align: center;">0.47</td> <td style="text-align: center;">5.3</td> </tr> <tr> <td>Main Circulating Pump³</td> <td>016020490</td> <td style="text-align: center;">20</td> <td style="text-align: center;">266,813</td> <td style="text-align: center;">93</td> <td style="text-align: center;">773.7</td> <td style="text-align: center;">2,869</td> <td style="text-align: center;">8.3</td> <td style="text-align: center;">0.15</td> <td style="text-align: center;">1.2</td> </tr> <tr> <td>Main Salt Water Cooling Pump</td> <td>016110076</td> <td style="text-align: center;">20</td> <td style="text-align: center;">439,919</td> <td style="text-align: center;">162</td> <td style="text-align: center;">1,646.0</td> <td style="text-align: center;">2,716</td> <td style="text-align: center;">10.2</td> <td style="text-align: center;">0.26</td> <td style="text-align: center;">2.6</td> </tr> <tr> <td>Main Gland Exhaust Motor¹¹</td> <td>174802040</td> <td style="text-align: center;">20</td> <td style="text-align: center;">294,476</td> <td style="text-align: center;">71</td> <td style="text-align: center;">898.8</td> <td style="text-align: center;">4,148</td> <td style="text-align: center;">12.7</td> <td style="text-align: center;">0.18</td> <td style="text-align: center;">2.1</td> </tr> <tr> <td>Reserve Feed Transfer Pump</td> <td>016060107</td> <td style="text-align: center;">20</td> <td style="text-align: center;">--</td> <td style="text-align: center;">79</td> <td style="text-align: center;">602.6</td> <td style="text-align: center;">7,306¹²</td> <td style="text-align: center;">7.7</td> <td style="text-align: center;">0.13</td> <td style="text-align: center;">0.9</td> </tr> <tr> <td>Main Feed Boost Pump Motor^{7, 13}</td> <td>174010180</td> <td style="text-align: center;">40</td> <td style="text-align: center;">152,936</td> <td style="text-align: center;">80</td> <td style="text-align: center;">2,751.1</td> <td style="text-align: center;">1,912</td> <td style="text-align: center;">34.4</td> <td style="text-align: center;">0.23</td> <td style="text-align: center;">7.9</td> </tr> <tr> <td>Main Condenser Piping¹⁴</td> <td>--</td> <td style="text-align: center;">20</td> <td style="text-align: center;">294,476</td> <td style="text-align: center;">85</td> <td style="text-align: center;">585.6</td> <td style="text-align: center;">1,464</td> <td style="text-align: center;">6.9</td> <td style="text-align: center;">0.22</td> <td style="text-align: center;">1.5</td> </tr> <tr> <td>Steam Smothering Piping¹⁴</td> <td>--</td> <td style="text-align: center;">40</td> <td style="text-align: center;">--</td> <td style="text-align: center;">93</td> <td style="text-align: center;">1,170.5</td> <td style="text-align: center;">--</td> <td style="text-align: center;">12.6</td> <td style="text-align: center;">0.24</td> <td style="text-align: center;">3.0</td> </tr> </tbody> </table>	Equipment Name	Related CID/APL Number(s)	Number of Equipments	Total Operating Hours	Total CM Events	Total CM Man-Hours	Average Operating Hours Between CM Events	Average Man-Hours Per Event	Average Number of CM Events Per Ship Per Month	Average CM Man-Hours Per Ship Per Month	Distillers	080100016 080030009	10 10	165,762 232,992	565 696	9,567.6 14,869.3	293 335	16.9 21.5	1.99 2.04	33.2 43.8	Forced Draft Blowers	057960005 057960009 057960003 0579600152	40 8 16 16	437,344 83,952 198,750 159,792	813 309 212 182	16,209.6 5,858.9 1,489.5 1,098.4	538 272 938 878	19.9 19.0 7.0 6.0	2.64 4.29 1.51 1.65	52.6 81.4 10.6 10.0	Main Feed Pump	016031226 017020014	18 42	106,018 333,617	234 718	3,190.7 10,307.2	453 465	13.6 14.4	1.31 1.58	17.9 22.8	Main Feed Pump Turbine	057100043 057260147 ¹	18 42	106,018 333,617	271 576	2,973.8 4,658.3	391 579	10.9 8.1	1.52 1.27	16.7 10.3	Combustion and Feedwater Control System	619510065 619510060	12 28	214,764 6,5,074	219 1,220	1,626.6 5,544.1	985 545	7.4 4.5	1.23 2.70	9.1 12.3	SGT Turbine and Reduction Gear ²	057150225	20	107,493	90	1,736.0	1,194	19.3	0.79	15.2	High Pressure Turbine	051150015, -17, -21 051010074, -75, -76	10 10	118,902 183,800	269 352	1,692.5 8,594.6	442 522	8.3 24.4	0.93 1.01	5.9 25.1	Low Pressure Turbine	051150014, -18 051010074, -82, -77	10 10	118,902 183,800	105 92	1,772.8 3,184.3	1,132 1,996	16.9 14.6	0.36 0.27	6.2 9.3	Auxiliary Circulating Pump ³	016050209	8	60,912	17	639.0	3,583	37.6	0.33	12.4	Auxiliary Condensate Pump ³	016020978	8	107,493	23	101.7	4,674	4.4	0.45	2.0	Main Feed Booster Pump	016000061	60	448,717	800	11,010.3	561	16.3	1.27	20.7	Main Feed Booster Pump Turbine ³	057950056	18	165,076	238	3,125.8	694	14.0	0.41	5.3	Main Condensate Pump	016020495	40	457,515	544	12,192.3	841	22.4	0.86	19.4	Main Condensate Pump Turbine ³	057950053	18	200,730	383	5,550.4	524	14.5	0.69	9.9	Main Lube Oil Pump ⁴	016160255 016160325	40	426,396	333	904.2	3,280	7.0	0.21	1.4	016160322	20	136,215	12	234.3	11,151	19.5	0.02	0.4	016160417 ⁵	20	136,215	12	234.3	11,151	19.5	0.02	0.4	Main Lube Oil Pump Turbine ³	057150137 057150170 057150179	2 16 2	275,459	486	3,638.1	567	7.5	0.77	5.8	Soot Blowers ⁶	81303028 ⁷ 81302074 81302075 81302081	132 56 112 84	470,190	506	5,142.6	928 ⁸	10.2	0.80	8.2	Main Reduction Gear ⁹	69150039 69150060 69150064 69150094 69150095	10	118,902	109	599.9	1,090	5.5	0.37	1.75	SGT AC Generator ¹⁰	161140005	20	107,493	20	280.3	5,375	14.0	0.18	2.5	Main Circulating Pump Turbine ³	057950046	12	155,574	169	1,916.3	921	11.5	0.47	5.3	Main Circulating Pump ³	016020490	20	266,813	93	773.7	2,869	8.3	0.15	1.2	Main Salt Water Cooling Pump	016110076	20	439,919	162	1,646.0	2,716	10.2	0.26	2.6	Main Gland Exhaust Motor ¹¹	174802040	20	294,476	71	898.8	4,148	12.7	0.18	2.1	Reserve Feed Transfer Pump	016060107	20	--	79	602.6	7,306 ¹²	7.7	0.13	0.9	Main Feed Boost Pump Motor ^{7, 13}	174010180	40	152,936	80	2,751.1	1,912	34.4	0.23	7.9	Main Condenser Piping ¹⁴	--	20	294,476	85	585.6	1,464	6.9	0.22	1.5	Steam Smothering Piping ¹⁴	--	40	--	93	1,170.5	--	12.6	0.24	3.0	<p>¹ Includes only data from 1000-KM sets (i.e., DLG-6, -7, -8, -14, -15).</p> <p>² Boiler operating hours between corrective-maintenance events.</p> <p>³ Excludes DLG-15 data.</p> <p>⁴ Excludes DLG-13 data.</p> <p>⁵ Some corrective-maintenance events have been omitted as nonrepresentative.</p> <p>⁶ Excludes DLG-10, -12, -13, and -14 data.</p> <p>⁷ Includes only Generation I HODCS data (July 1966 to December 1969).</p> <p>⁸ Excludes DLG-9 data.</p> <p>⁹ Includes only DLG-6, -7, and -8 data.</p> <p>¹⁰ For DLG-6 and DLG-15 only (after AAW conversion).</p> <p>¹¹ Average ship steaming hours between corrective-maintenance events.</p>									
Equipment Name	Related CID/APL Number(s)	Number of Equipments	Total Operating Hours	Total CM Events	Total CM Man-Hours	Average Operating Hours Between CM Events	Average Man-Hours Per Event	Average Number of CM Events Per Ship Per Month	Average CM Man-Hours Per Ship Per Month																																																																																																																																																																																																																																																																																																											
Distillers	080100016 080030009	10 10	165,762 232,992	565 696	9,567.6 14,869.3	293 335	16.9 21.5	1.99 2.04	33.2 43.8																																																																																																																																																																																																																																																																																																											
Forced Draft Blowers	057960005 057960009 057960003 0579600152	40 8 16 16	437,344 83,952 198,750 159,792	813 309 212 182	16,209.6 5,858.9 1,489.5 1,098.4	538 272 938 878	19.9 19.0 7.0 6.0	2.64 4.29 1.51 1.65	52.6 81.4 10.6 10.0																																																																																																																																																																																																																																																																																																											
Main Feed Pump	016031226 017020014	18 42	106,018 333,617	234 718	3,190.7 10,307.2	453 465	13.6 14.4	1.31 1.58	17.9 22.8																																																																																																																																																																																																																																																																																																											
Main Feed Pump Turbine	057100043 057260147 ¹	18 42	106,018 333,617	271 576	2,973.8 4,658.3	391 579	10.9 8.1	1.52 1.27	16.7 10.3																																																																																																																																																																																																																																																																																																											
Combustion and Feedwater Control System	619510065 619510060	12 28	214,764 6,5,074	219 1,220	1,626.6 5,544.1	985 545	7.4 4.5	1.23 2.70	9.1 12.3																																																																																																																																																																																																																																																																																																											
SGT Turbine and Reduction Gear ²	057150225	20	107,493	90	1,736.0	1,194	19.3	0.79	15.2																																																																																																																																																																																																																																																																																																											
High Pressure Turbine	051150015, -17, -21 051010074, -75, -76	10 10	118,902 183,800	269 352	1,692.5 8,594.6	442 522	8.3 24.4	0.93 1.01	5.9 25.1																																																																																																																																																																																																																																																																																																											
Low Pressure Turbine	051150014, -18 051010074, -82, -77	10 10	118,902 183,800	105 92	1,772.8 3,184.3	1,132 1,996	16.9 14.6	0.36 0.27	6.2 9.3																																																																																																																																																																																																																																																																																																											
Auxiliary Circulating Pump ³	016050209	8	60,912	17	639.0	3,583	37.6	0.33	12.4																																																																																																																																																																																																																																																																																																											
Auxiliary Condensate Pump ³	016020978	8	107,493	23	101.7	4,674	4.4	0.45	2.0																																																																																																																																																																																																																																																																																																											
Main Feed Booster Pump	016000061	60	448,717	800	11,010.3	561	16.3	1.27	20.7																																																																																																																																																																																																																																																																																																											
Main Feed Booster Pump Turbine ³	057950056	18	165,076	238	3,125.8	694	14.0	0.41	5.3																																																																																																																																																																																																																																																																																																											
Main Condensate Pump	016020495	40	457,515	544	12,192.3	841	22.4	0.86	19.4																																																																																																																																																																																																																																																																																																											
Main Condensate Pump Turbine ³	057950053	18	200,730	383	5,550.4	524	14.5	0.69	9.9																																																																																																																																																																																																																																																																																																											
Main Lube Oil Pump ⁴	016160255 016160325	40	426,396	333	904.2	3,280	7.0	0.21	1.4																																																																																																																																																																																																																																																																																																											
016160322	20	136,215	12	234.3	11,151	19.5	0.02	0.4																																																																																																																																																																																																																																																																																																												
016160417 ⁵	20	136,215	12	234.3	11,151	19.5	0.02	0.4																																																																																																																																																																																																																																																																																																												
Main Lube Oil Pump Turbine ³	057150137 057150170 057150179	2 16 2	275,459	486	3,638.1	567	7.5	0.77	5.8																																																																																																																																																																																																																																																																																																											
Soot Blowers ⁶	81303028 ⁷ 81302074 81302075 81302081	132 56 112 84	470,190	506	5,142.6	928 ⁸	10.2	0.80	8.2																																																																																																																																																																																																																																																																																																											
Main Reduction Gear ⁹	69150039 69150060 69150064 69150094 69150095	10	118,902	109	599.9	1,090	5.5	0.37	1.75																																																																																																																																																																																																																																																																																																											
SGT AC Generator ¹⁰	161140005	20	107,493	20	280.3	5,375	14.0	0.18	2.5																																																																																																																																																																																																																																																																																																											
Main Circulating Pump Turbine ³	057950046	12	155,574	169	1,916.3	921	11.5	0.47	5.3																																																																																																																																																																																																																																																																																																											
Main Circulating Pump ³	016020490	20	266,813	93	773.7	2,869	8.3	0.15	1.2																																																																																																																																																																																																																																																																																																											
Main Salt Water Cooling Pump	016110076	20	439,919	162	1,646.0	2,716	10.2	0.26	2.6																																																																																																																																																																																																																																																																																																											
Main Gland Exhaust Motor ¹¹	174802040	20	294,476	71	898.8	4,148	12.7	0.18	2.1																																																																																																																																																																																																																																																																																																											
Reserve Feed Transfer Pump	016060107	20	--	79	602.6	7,306 ¹²	7.7	0.13	0.9																																																																																																																																																																																																																																																																																																											
Main Feed Boost Pump Motor ^{7, 13}	174010180	40	152,936	80	2,751.1	1,912	34.4	0.23	7.9																																																																																																																																																																																																																																																																																																											
Main Condenser Piping ¹⁴	--	20	294,476	85	585.6	1,464	6.9	0.22	1.5																																																																																																																																																																																																																																																																																																											
Steam Smothering Piping ¹⁴	--	40	--	93	1,170.5	--	12.6	0.24	3.0																																																																																																																																																																																																																																																																																																											

Reliability and Maintainability Summary for DLG-9 Class Propulsion-System Equipment

TECHNIQUE DESCRIPTION SHEET

1. Item No.	2. Title			
26	Analysis of Corrective Maintenance Resource Consumption			
3. Description				
<p>A procedure was developed for identifying and ranking ship systems/equipments on the basis of maintenance resource consumption. The applicable maintenance resource measures include number of corrective maintenance actions, man-hours required and parts cost. The procedure was applied to a sampling of 108 destroyers involving seven classes (DE-1040, DE-1052, DEG-1, DLG-6, DLG-16, DLG-26, and DDG-2). The technique, based on use of MDCS data, includes methodology for using results to identify areas for further engineering analysis. The attached figure illustrates results of applying this technique.</p>				
DESIGN	4. Type of Technique	5. Cost Parameters	6. Effectiveness Parameters	7. Status
	Math Model <input checked="" type="checkbox"/>	Life Cycle _____	Effectiveness _____	Concept _____
	Computer Program <input checked="" type="checkbox"/>	Development _____	Perf. Capability _____	Technique Developed, Not Applied _____
	Engineering Procedure <input checked="" type="checkbox"/>	Procurement _____	Availability _____	Technique Applied One Time <input checked="" type="checkbox"/>
	Management Procedure _____	Installation _____	Reliability <input checked="" type="checkbox"/>	Technique Applied Recurrently _____
	_____	Maintenance <input checked="" type="checkbox"/>	Maintainability <input checked="" type="checkbox"/>	_____
	_____	Operation _____	None _____	_____
	_____	Mgt/Tech Service _____	_____	_____
	_____	Modification _____	_____	_____
	_____	None _____	_____	_____
APPLICATION	8. Type of System/Equipment	9. Life Cycle Phase	10. Functional Areas Supported	
	Total Ship _____	Concept Form. _____	Reliability Measurement Maintainability Measurement Ships Systems/Equipment Criticality Ranking	
	Hull Structure _____	Validation _____		
	Propulsion _____	Development _____		
	Electric Plant _____	Acquisition _____		
	Command & Surv. _____	Operation <input checked="" type="checkbox"/>		
	Auxiliaries _____	_____		
	Outfit/Furnish. _____	_____		
	Armament _____	_____		
Destroyers <input checked="" type="checkbox"/>	_____			
11. References (ARINC Research Corporation publications unless otherwise indicated)				
1. An Analysis of Corrective-Maintenance-Resource Consumption for Seven Destroyer Classes, Pub. 1225-01-1-1368, March 1975.				

Continued

TECHNIQUE DESCRIPTION SHEET

1. Item No.	2. Title				
26 (Cont)	Analysis of Corrective Maintenance Resource Consumption (Cont)				
Functional Area	Percent of Maintenance Man-Hours				
EIC	5	10	15	20	
1. Propulsion	F	19.7			
2. Auxiliary Systems	T	15.0			
3. Administration/Habitability	I	8.7			
4. Communications and Data	Q	6.4			
5. Radar/IFF	P				
6. Surface Missile	S	5.8			
7. Guns	G	5.1			
8. Hull Structure	A	4.2			
9. Navigation	L	3.7			
10. Electronic Test Equipment	W	2.9			
11. Interior Communications	M	2.8			
12. Sonar	R	2.8			
13. Countermeasures	N	2.5			
14. Anti-Submarine Warfare	J	2.4			
15. Electric Power Distribution	4	2.4			
16. Support Services	U	2.2			
17. Boats, Stowage/Handling	Y	2.1			Total Man-Hours
18. Electric Power Generation	3	2.1			Reported in
19. Special Systems	Z	0.7			Period 1970
20. Naval Intelligence Processing	H	0.1			Through 1973
21. Specialized Ordnance Equipment	8	0.1			From 108
					Destroyers:
					7,730,400

Typical Results of Maintenance Resource Consumption Analysis

TECHNIQUE DESCRIPTION SHEET

1. Item No.	2. Title			
27	Engineering Assessment of System/Equipment Maintainability			
3. Description				
<p>This technique encompasses design/document review and the observation of tests and related analyses as necessary to assess the maintainability of a shipboard system/equipment. Application of this technique to a variety of items is described in the references cited below.</p>				
DESIGN	4. Type of Technique	5. Cost Parameters	6. Effectiveness Parameters	7. Status
	Math Model	Life Cycle	Effectiveness	Concept
	Computer Program	Development	Perf. Capability	Technique Developed, Not Applied
	Engineering Procedure X	Procurement	Availability	
	Management Procedure	Installation	Reliability	Technique Applied One Time
		Maintenance	Maintainability	Technique Applied Recurrently X
		Operation	None	
		Mgt/Tech Service		
		Modification		
APPLICATION	8. Type of System/Equipment	9. Life Cycle Phase	10. Functional Areas Supported	
	Total Ship	Concept Form.	Maintainability Measurement Maintainability Prediction Maintenance Engineering Analysis Testing	
	Hull Structure	Validation X		
	Propulsion	Development X		
	Electric Plant	Acquisition X		
	Command & Surv.	Operation X		
	Auxiliaries			
	Outfit/Furnish.			
Armament X				
11. References (ARINC Research Corporation publications unless otherwise indicated)				
<ol style="list-style-type: none"> 1. Reliability and Maintainability Assessment of the Fast Automatic Shuttle Transfer (FAST) System (Missile Stream), Pub. 589-02-2-971, April 1969 2. Assessment of the Reliability and Maintainability Characteristics of the SSN-637 Class Submarine ASW System (U) (CONFIDENTIAL), Pub. 900-01-2-1005, Oct. 1969 3. Users Manual - Data and Computational Procedures for Assessment of the Reliability and Maintainability Characteristics of the SSN-637 Class Submarine ASW System, Pub. 901-01-4-1008, Oct. 1969 4. Engineering Assessment of Coastal Patrol and Interdiction Craft (CPIC) Weapon System, Pub. 1625-01-1-1353, Sept. 1974 				

TECHNIQUE DESCRIPTION SHEET

1. Item No.	2. Title							
28	Analyzing Shipboard Mechanical Equipment Maintenance and Cost Factors							
3. Description								
<p>This procedure consists of the collection of data and accomplishment of calculations as necessary to compute certain significant maintenance and cost factors associated with shipboard mechanical equipment. The maintenance and cost factors covered by this procedure are illustrated in the attached tables. The procedure is described in ref. 1, and its application to selected destroyer propulsion equipments is reported upon in ref. 2.</p>								
DESIGN	4. Type of Technique		5. Cost Parameters					
	Math Model	<input checked="" type="checkbox"/>	Life Cycle	—	Effectiveness	—	Concept	—
	Computer Program	<input checked="" type="checkbox"/>	Development	—	Perf. Capability	—	Technique Developed, Not Applied	—
	Engineering Procedure	<input checked="" type="checkbox"/>	Procurement	—	Availability	—	Technique Applied One Time	—
	Management Procedure	—	Installation	—	Reliability	<input checked="" type="checkbox"/>	Technique Applied Recurrently	—
	—	—	Maintenance	<input checked="" type="checkbox"/>	Maintainability	<input checked="" type="checkbox"/>	—	—
	—	—	Operation	—	None	—	—	—
	—	—	Mgt/Tech Service	—	—	—	—	—
	—	—	Modification	—	—	—	—	—
	—	—	None	—	—	—	—	—
APPLICATION	8. Type of System/Equipment		9. Life Cycle Phase		10. Functional Areas Supported			
	Total Ship	—	Concept Form.	—	Reliability Measurement			
	Hull Structure	—	Validation	—	Maintainability Measurement			
	Propulsion	<input checked="" type="checkbox"/>	Development	—	Reliability Prediction			
	Electric Plant	P	Acquisition	—	Maintainability Prediction			
	Command & Surv.	P	Operation	<input checked="" type="checkbox"/>	Maintenance Engineering Analysis			
	Auxiliaries	P	—	—	Reliability Engineering Analysis			
	Outfit/Furnish.	—	—	—	—			
Armament	P	—	—	—				
11. References (ARINC Research Corporation publications unless otherwise indicated)								
<ol style="list-style-type: none"> 1. Procedural Techniques for Analysis of Historical Maintenance Data Relating to Shipboard Mechanical Equipments, Pub. 594-01-1-959, April 1969 (Ch. 3) 2. Reliability and Maintainability Analysis of Selected Mechanical Equipments, Pub. 594-01-1-960, April 1969 								

Continued

TECHNIQUE DESCRIPTION SHEET

1. Item No. 28 (Cont)	2. Title Analyzing Shipboard Mechanical Equipment Maintenance and Cost Factors (Cont)
---------------------------------	--

Item	Maintenance Factor	Formula
1	Percent replacement parts within assembly, by equipment by vendor	$\frac{\text{Total number of parts replaced within a given assembly}}{\text{Total parts replaced within next higher assembly}} \times 100$
2	Type of equipment failure (High 5). Rank in descending order, by equipment, by vendor.	Total of given types of failures
3	Cause of equipment failure (High 5). Rank in descending order, by equipment, by vendor.	Total of a given failed part type/name
4	Number of cluster removals	Total number of corrective maintenance actions occurring within successive 30-day intervals which required two or more part replacements for each equipment, by vendor.
5	Manufacturers of high-replacement-rate equipments (High 2). Rank in descending order, by vendor.	$\frac{\text{Total parts replaced, by equipment by vendor}}{\text{Total operating hours, by equipment by vendor}}$
6	Technician's level and rating for majority of equipment repairs requiring part replacements	List technician levels or grades used during equipment maintenance requiring part replacement and the corresponding percent of total maintenance performed by each grade, by equipment, by vendor.
7(a)	Number "Hits"	Number of satisfied stock requests by equipment, by vendor.
7(b)	Number "Misses"	Number of unsatisfied stock requests* by equipment, by vendor.
8	Mean time awaiting parts	Same as Item 16, Table 2 (MTLA)
9	Number of parts replaced due to equipment failure (corrective maintenance)	Total parts replaced due to equipment failure, by equipment, by vendor.
10(a)	Number of parts replaced during planned maintenance	Total parts replaced during planned maintenance, by equipment, by vendor.
10(b)	Number of parts replaced during preventive maintenance	Total parts replaced during preventive maintenance, by equipment, by vendor.
11	Number of maintenance actions	Total maintenance actions by equipment, by vendor, by ship.
12	Percent of total maintenance actions by equipment within system. Rank in decreasing order.	$\frac{\text{Total maintenance actions by equipment}}{\text{Total maintenance actions by system}} \times 100$
13	Technician's levels and ratings for all maintenance actions	List number of technician levels or grades used for equipment maintenance and the corresponding percent of total maintenance performed by each grade, by equipment, by vendor.
14	Ratio of troubleshoot man-hours to total maintenance man-hours	$\frac{\text{Total troubleshoot man-hours by equipment, by vendor}}{\text{Total maintenance man-hours by equipment, by vendor}}$
15	Number of preventive maintenance actions	Total number of preventive maintenance actions by equipment, by vendor.
16	Average number of parts used per maintenance action	$\frac{\text{Total parts used}}{\text{Total maintenance actions}}$

* As used here, an unsatisfied stock request means any stock request that is not satisfied immediately upon submittal.

Formulas for Maintenance Factors

Continued

TECHNIQUE DESCRIPTION SHEET

1. Item No.	2. Title
28 (Cont)	Analyzing Shipboard Mechanical Equipment Maintenance and Cost Factors (Cont)

Item	Cost Factor	Formula
1	Parts Cost	$\sum_{i=1}^n (\text{Number of Parts of } i^{\text{th}} \text{ Type Replaced}) (\text{Cost of } i^{\text{th}} \text{ Part Type})$ where n = Number of Types of Parts Replaced
2	Average Logistics Cost per Maintenance Action	$\frac{\text{Total Logistic Actions} \times \text{Average Cost/Logistic Action}}{\text{Total Maintenance Actions}}$
3	Average Man-Hour Cost per Maintenance Action	$\frac{\text{Total Maintenance Man-Hours} \times \text{Average Cost/Man-Hour}}{\text{Total Maintenance Actions}}$
4	Average Man-Hour Cost per Corrective Maintenance Action	$\frac{\text{Total Corrective Maintenance Man-Hours} \times \text{Average Cost/Man Hour}}{\text{Total Corrective Maintenance Actions}}$
5	Average Man-Hour Cost per Preventive Maintenance Action	$\frac{\text{Total Preventive Maintenance Man-Hours} \times \text{Average Cost/Man Hour}}{\text{Total Preventive Maintenance Actions}}$
6	Average Man-Hour Cost per Planned Maintenance Action	$\frac{\text{Total Planned Maintenance Man-Hours} \times \text{Average Cost/Man-Hour}}{\text{Total Planned Maintenance Actions}}$
7	Average Parts Cost per Maintenance Action	$\frac{\text{Total Cost of Replaced Parts}}{\text{Total Maintenance Actions}}$
8	Average Parts Cost per Corrective Maintenance Action	$\frac{\text{Total Cost of Parts Replaced During Corrective Maintenance}}{\text{Total Corrective Maintenance Actions}}$
9	Average Parts Cost per Preventive Maintenance Action	$\frac{\text{Total Cost of Parts Replaced During Preventive Maintenance}}{\text{Total Preventive Maintenance Actions}}$
10	Average Cost to Support per Maintenance Action	Item 2 + Item 3 + Item 7
11	Average Cost to Support per Equipment Operating Hour	$\frac{\text{Item 10} \times \text{Total Maintenance Actions}}{\text{Total Equipment Operating Hours}}$
12	Average Total Cost to Support per Year	$\frac{\text{Item 10} \times \text{Total Maintenance Actions}}{\text{Number Years Observed}}$
13	Average Cost to Support per Year at each Maintenance Echelon	$\frac{\text{Item 10 by Maintenance Echelon} \times \text{Total Maintenance at Each Echelon}}{\text{Number of Years Observed for Appropriate Echelon (i.e., Shipboard, Tender, or Shipyard)}}$

Formulas for Cost Factors

TECHNIQUE DESCRIPTION SHEET

1. Item No.	2. Title				
29	Reliability and Maintainability Indices for Shipboard Equipments				
3. Description					
<p>A procedure for utilizing 3M data to compute reliability and maintainability indices was developed and applied to selected shipboard systems. The procedure utilizes computer programs for identifying and classifying MDCS maintenance events and calculating the indices: mean time between failures (forced shutdown), mean time between corrective maintenance, mean time to repair and median time to repair. The technique was applied to selected shipboard main propulsion and auxiliary equipment for all types of ships, and compiled into a data bank for shipboard machinery. The attached figure illustrates the format and content of the data bank.</p>					
DESIGN	4. Type of Technique		5. Cost Parameters	6. Effectiveness Parameters	7. Status
	Math Model	<input checked="" type="checkbox"/>	Life Cycle	Effectiveness	Concept
	Computer Program	<input checked="" type="checkbox"/>	Development	Perf. Capability	Technique Developed, Not Applied
	Engineering Procedure	<input type="checkbox"/>	Procurement	Availability	
	Management Procedure	<input type="checkbox"/>	Installation	Reliability	Technique Applied One Time
		<input type="checkbox"/>	Maintenance	Maintainability	Technique Applied Recurrently
		<input type="checkbox"/>	Operation	None	
		<input type="checkbox"/>	Mgt/Tech Service	Utilization	<input checked="" type="checkbox"/>
		<input type="checkbox"/>	Modification		
		<input type="checkbox"/>	None	<input checked="" type="checkbox"/>	
APPLICATION	8. Type of System/Equipment		9. Life Cycle Phase	10. Functional Areas Supported	
	Total Ship	<input type="checkbox"/>	Concept Form.	Reliability Measurement	
	Hull Structure	<input type="checkbox"/>	Validation	Maintainability Measurement	
	Propulsion	<input checked="" type="checkbox"/>	Development		
	Electric Plant	<input type="checkbox"/>	Acquisition		
	Command & Surv.	<input type="checkbox"/>	Operation		
	Auxiliaries	<input checked="" type="checkbox"/>			
	Outfit/Furnish.	<input type="checkbox"/>			
Armament	<input type="checkbox"/>				
11. References (ARINC Research Corporation publications unless otherwise indicated)					
<p>1. Establishment of Reliability and Maintainability Data Bank for Shipboard Machinery, Vol. I – Description of Technique; Vol. II – Data Sheets, Pub. OE13-01-1-1224, March 1973</p>					

Continued

TECHNIQUE DESCRIPTION SHEET

1. Item No. 29 (Cont)	2. Title Reliability and Maintainability Indices for Shipboard Equipments
SHIPBOARD MACHINERY RELIABILITY AND MAINTAINABILITY DATA BANK	
Equipment Identification	
Noun Name: <u>Turbine, Main Feed Booster Pump</u> General Description: <u>Turbine Steam Main Feed Booster Pump</u> CID/APL Number(s): <u>057150032</u> Federal Stock Number: <u>4320-368-3092</u> Equipment Identification Code: <u>ZQ12000/F308300</u> Technical Manual: <u>347-1051</u> Manufacturer: <u>16712 De Laval Turbine Inc.</u>	
Basic Data	
Ship Population: <u>DD 697,709,716,718,723</u> *(1) Equip. Population/Ship: <u>5</u> ea/DD Equip. Population in Data Base: <u>192</u> Data Assessment Period: <u>7/1/67 - 6/30/69</u> Utilization Factors: <u>DD-S: A = 0.50; B = 0.33; C = 0.00;</u> Total Equip. Operating Time (hours): <u>925212</u> Total Number of: Failures (CM _f): <u>52</u> Corrective Maintenance Events (CM): <u>484</u> Total CM _f Repair Man-Hours: <u>2076</u> Total CM Repair Man-Hours: <u>6728</u> Maintenance Factors: <u>0.67</u>	
Reliability Indices**	
Mean Time Between Failure (Forced Shutdown Corrective Maintenance) <u>MTBCM_f</u> : <u>17792</u> 90% Confidence Interval <u>Upper Limit:</u> <u>22715</u> <u>Lower Limit:</u> <u>14122</u>	Mean Time Between Corrective Maintenance <u>MTBCM</u> : <u>1912</u> 90% Confidence Interval <u>Upper Limit:</u> <u>2063</u> <u>Lower Limit:</u> <u>1773</u>
Maintainability Indices	
Corrective Maintenance - (Forced Shutdown) Failure Events Only <u>MTTR_f</u> : <u>26.6</u> <u>MCMM_f</u> : <u>10.1</u> <u>Max. Observed MH</u> : <u>324</u> <u>MCMM_f</u> : <u>39.9</u> <u>Variance</u> : <u>4744</u>	Corrective Maintenance - (All Events) <u>MTTR_{cm}</u> : <u>9.3</u> <u>MCMM_{cm}</u> : <u>3.0</u> <u>Max. Observed MH</u> : <u>512</u> <u>MCMM_{cm}</u> : <u>13.9</u> <u>Variance</u> : <u>1617</u>
<u>Indicated Distribution(s): Exponential _____</u> <u>Normal _____</u> <u>Log Normal X</u>	
<u>*REMARKS: *(1) 725,730,743,745,746,755,758,759,760,780,781,782,783,786, 787,789,790,806,808,818,819,820,826,830,832,836,837,839,840,851,852,864, 870,871,875,876,880,881,884,885,886,888; ##Reliability indices developed for ARINC Research Publication 933-02-3-1153, dated December 1971</u>	
<u>Example of R&M Indices</u>	

TECHNIQUE DESCRIPTION SHEET

1. Item No.	2. Title			
30	Development of Equipment Behavior Measures			
3. Description				
<p>Measures of equipment behavior were developed and applied to selected propulsion equipments of certain destroyer classes. The measures reflect reliability, maintainability, degradation maintenance burden, and parts-cost burden. Data used in applying the technique consist of MDCS data, casualty reports, overhaul departure reports, and records of steaming hours. The attached figures illustrate typical results of the application of the procedure. The procedure is applicable to any system/equipment for which MDCS and utilization data are available, and is useful in evaluation of maintenance plans on other analyses involving reliability/maintainability trends.</p>				
DESIGN	4. Type of Technique	5. Cost Parameters	6. Effectiveness Parameters	7. Status
	Math Model <input checked="" type="checkbox"/>	Life Cycle <input type="checkbox"/>	Effectiveness <input type="checkbox"/>	Concept <input type="checkbox"/>
	Computer Program <input checked="" type="checkbox"/>	Development <input type="checkbox"/>	Perf. Capability <input type="checkbox"/>	Technique Developed, Not Applied <input type="checkbox"/>
	Engineering Procedure <input checked="" type="checkbox"/>	Procurement <input type="checkbox"/>	Availability <input type="checkbox"/>	<input type="checkbox"/>
	Management Procedure <input type="checkbox"/>	Installation <input type="checkbox"/>	Reliability <input checked="" type="checkbox"/>	Technique Applied One Time <input type="checkbox"/>
	_____	Maintenance <input checked="" type="checkbox"/>	Maintainability <input checked="" type="checkbox"/>	Technique Applied Recurrently <input checked="" type="checkbox"/> X
	_____	Operation <input type="checkbox"/>	None <input type="checkbox"/>	<input type="checkbox"/>
	_____	Mgt/Tech Service <input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
	_____	Modification <input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
	_____	None <input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
APPLICATION	8. Type of System/Equipment	9. Life Cycle Phase	10. Functional Areas Supported	
	Total Ship <input type="checkbox"/>	Concept Form. <input type="checkbox"/>	Reliability Trend Analysis	
	Hull Structure <input type="checkbox"/>	Validation <input type="checkbox"/>	Maintainability Trend Analysis	
	Propulsion <input checked="" type="checkbox"/>	Development <input type="checkbox"/>	Reliability Measurement	
	Electric Plant <input type="checkbox"/>	Acquisition <input type="checkbox"/>	Maintainability Measurement	
	Command & Surv. <input type="checkbox"/>	Operation <input checked="" type="checkbox"/>	Maintenance Strategy Planning	
	Auxiliaries <input checked="" type="checkbox"/>	<input type="checkbox"/>	EOC Maintenance Management	
	Outfit/Furnish. <input type="checkbox"/>	<input type="checkbox"/>		
	Armament <input type="checkbox"/>	<input type="checkbox"/>		
Destroyers <input checked="" type="checkbox"/>	<input type="checkbox"/>			
<p>11. References (ARINC Research Corporation publications unless otherwise indicated)</p> <ol style="list-style-type: none"> 1. Executive Summary, A Study to Determine the Annualized Maintenance Cost and Feasibility of Adopting EOC for Destroyer-Type Ships, Pub. 1024-01-1-1293, March 1974 2. Final Report, A Study to Determine the Annualized Maintenance Cost and Feasibility of Adopting EOC for Destroyer-Type Ships, Pub. 1024-01-2-1297, June 1974 3. Development of Equipment Behavior Measures for Selected Equipments in the Propulsion Plant of DDG-2 Class Ships, Pub. 1623-01-1-1347, Dec. 1974 4. Determining Reliability and Degradation of Shipboard Machinery, Pub. 6801-1448, Jan. 1976 				

Continued

TECHNIQUE DESCRIPTION SHEET

1. Item No.	2. Title																																										
30 (Cont)	Development of Equipment Behavior Measures (Cont)																																										
<p>Average Actions per Equipment per Quarter</p> <p>Quarters After Ship Overhaul</p> <p>Degradation Measures for the Main Boiler</p> <table border="1"> <thead> <tr> <th>Quarter</th> <th>All maintenance actions (F = 9.65, r² = .47)</th> <th>Failure-related maintenance actions (F = 13.6, r² = .55)</th> </tr> </thead> <tbody> <tr><td>1</td><td>2.2</td><td>0.8</td></tr> <tr><td>2</td><td>3.8</td><td>1.0</td></tr> <tr><td>3</td><td>5.5</td><td>1.5</td></tr> <tr><td>4</td><td>4.2</td><td>1.4</td></tr> <tr><td>5</td><td>3.8</td><td>1.2</td></tr> <tr><td>6</td><td>1.8</td><td>0.7</td></tr> <tr><td>7</td><td>2.8</td><td>1.0</td></tr> <tr><td>8</td><td>4.8</td><td>1.1</td></tr> <tr><td>9</td><td>8.3</td><td>1.6</td></tr> <tr><td>10</td><td>6.0</td><td>1.3</td></tr> <tr><td>11</td><td>4.0</td><td>0.9</td></tr> <tr><td>12</td><td>9.8</td><td>1.6</td></tr> <tr><td>13</td><td>9.2</td><td>1.4</td></tr> </tbody> </table>		Quarter	All maintenance actions (F = 9.65, r² = .47)	Failure-related maintenance actions (F = 13.6, r² = .55)	1	2.2	0.8	2	3.8	1.0	3	5.5	1.5	4	4.2	1.4	5	3.8	1.2	6	1.8	0.7	7	2.8	1.0	8	4.8	1.1	9	8.3	1.6	10	6.0	1.3	11	4.0	0.9	12	9.8	1.6	13	9.2	1.4
Quarter	All maintenance actions (F = 9.65, r² = .47)	Failure-related maintenance actions (F = 13.6, r² = .55)																																									
1	2.2	0.8																																									
2	3.8	1.0																																									
3	5.5	1.5																																									
4	4.2	1.4																																									
5	3.8	1.2																																									
6	1.8	0.7																																									
7	2.8	1.0																																									
8	4.8	1.1																																									
9	8.3	1.6																																									
10	6.0	1.3																																									
11	4.0	0.9																																									
12	9.8	1.6																																									
13	9.2	1.4																																									
<p>Average Actions per Equipment per Quarter</p> <p>Quarters After Ship Overhaul</p> <p>Degradation Measures for the Forced Draft Blower</p> <table border="1"> <thead> <tr> <th>Quarter</th> <th>All maintenance actions (F = 9.7, r² = .47)</th> <th>Failure-related maintenance actions (F = 13.6, r² = .55)</th> </tr> </thead> <tbody> <tr><td>1</td><td>0.5</td><td>0.5</td></tr> <tr><td>2</td><td>0.6</td><td>0.6</td></tr> <tr><td>3</td><td>0.8</td><td>0.8</td></tr> <tr><td>4</td><td>0.5</td><td>0.5</td></tr> <tr><td>5</td><td>0.5</td><td>0.5</td></tr> <tr><td>6</td><td>0.5</td><td>0.5</td></tr> <tr><td>7</td><td>0.5</td><td>0.5</td></tr> <tr><td>8</td><td>0.9</td><td>0.9</td></tr> <tr><td>9</td><td>1.0</td><td>1.0</td></tr> <tr><td>10</td><td>0.9</td><td>0.9</td></tr> <tr><td>11</td><td>1.1</td><td>1.1</td></tr> <tr><td>12</td><td>0.9</td><td>0.9</td></tr> <tr><td>13</td><td>0.8</td><td>0.8</td></tr> </tbody> </table>		Quarter	All maintenance actions (F = 9.7, r² = .47)	Failure-related maintenance actions (F = 13.6, r² = .55)	1	0.5	0.5	2	0.6	0.6	3	0.8	0.8	4	0.5	0.5	5	0.5	0.5	6	0.5	0.5	7	0.5	0.5	8	0.9	0.9	9	1.0	1.0	10	0.9	0.9	11	1.1	1.1	12	0.9	0.9	13	0.8	0.8
Quarter	All maintenance actions (F = 9.7, r² = .47)	Failure-related maintenance actions (F = 13.6, r² = .55)																																									
1	0.5	0.5																																									
2	0.6	0.6																																									
3	0.8	0.8																																									
4	0.5	0.5																																									
5	0.5	0.5																																									
6	0.5	0.5																																									
7	0.5	0.5																																									
8	0.9	0.9																																									
9	1.0	1.0																																									
10	0.9	0.9																																									
11	1.1	1.1																																									
12	0.9	0.9																																									
13	0.8	0.8																																									
<p>Sample Results of Behavior-Measure Technique Application</p>																																											

TECHNIQUE DESCRIPTION SHEET

1. Item No.	2. Title			
31	Analysis of Planned Maintenance System Effectiveness			
3. Description				
<p>This technique is an engineering process designed to determine the degree of readiness improvement attributable to the Planned Maintenance System (PMS). The procedure involves the following steps:</p> <ul style="list-style-type: none"> a. Evaluate all pertinent Navy reports to determine indicators of equipment readiness and PMS accomplishment rates. b. Develop data acceptance guidelines to eliminate any data source that may bias the overall results. c. Correlate equipment readiness indicators with PMS accomplishment rates. d. Evaluate the validity of the results with respect to sample size and any basic assumptions. e. Recommend any necessary further actions. 				
<p>Application of the above procedure to selected equipments and ships is illustrated by ref. 1.</p>				
DESIGN	4. Type of Technique	5. Cost Parameters	6. Effectiveness Parameters	7. Status
	Math Model <input checked="" type="checkbox"/>	Life Cycle _____	Effectiveness <input checked="" type="checkbox"/>	Concept _____
	Computer Program _____	Development _____	Perf. Capability _____	Technique Developed, _____ Not Applied
	Engineering Procedure <input checked="" type="checkbox"/>	Procurement _____	Availability _____	
	Management Procedure _____	Installation _____	Reliability _____	Technique Applied One Time <input checked="" type="checkbox"/>
	_____	Maintenance _____	Maintainability <input checked="" type="checkbox"/>	Technique Applied Recurrently _____
	_____	Operation _____	None _____	
	_____	Mgt/Tech Service _____		
	_____	Modification <input checked="" type="checkbox"/>		
	_____	None _____		
APPLICATION	8. Type of System/Equipment	9. Life Cycle Phase	10. Functional Areas Supported	
	Total Ship _____	Concept Form. _____	Planned Maintenance System (PMS) Maintenance Engineering Analysis	
	Hull Structure <input checked="" type="checkbox"/>	Validation _____		
	Propulsion <input checked="" type="checkbox"/>	Development _____		
	Electric Plant <input checked="" type="checkbox"/>	Acquisition _____		
	Command & Surv. <input checked="" type="checkbox"/>	Operation <input checked="" type="checkbox"/>		
	Auxiliaries <input checked="" type="checkbox"/>	_____		
	Outfit/Furnish. <input checked="" type="checkbox"/>	_____		
Armament <input checked="" type="checkbox"/>	_____			
11. References (ARINC Research Corporation publications unless otherwise indicated)				
<p>1. Effectiveness of PMS for Shipboard Electronic Equipment, Vol. III, Pub. 1627-01-3-1411, June 1975</p>				

TECHNIQUE DESCRIPTION SHEET

1. Item No.	2. Title				
32	Measurement/Assessment of Ship Material Condition (Based on Quantity of Deferred Maintenance)				
3. Description					
<p>The procedure provides for measuring/assessing ship system/equipment material condition based on quantity of deferred maintenance, impact on operational capability, and mission essentiality. Data bases used in procedure include casualty reports and the Current Ships Maintenance Project (CSMP). The procedure consists of seven basic steps, designed to:</p> <ul style="list-style-type: none"> a. Classify systems/equipments in terms of mission essentiality. b. Classify systems/equipments in terms of operational status. c. Classify systems/equipments in terms of extent of required maintenance. d. Summarize material condition status. e. Rank systems/equipments. f. Determine trends in material condition. g. Compare material condition against a standard. 					
<p>The attached figure illustrates the procedure.</p>					
DESIGN	4. Type of Technique	5. Cost Parameters	6. Effectiveness Parameters	7. Status	
	Math Model	Life Cycle	Effectiveness	Concept	
	Computer Program	Development	Perf. Capability	X	
	Engineering Procedure	Procurement	Availability		
	Management Procedure	Installation	Reliability		
		Maintenance	X	Maintainability	
		Operation		None	
		Mgt/Tech Service			
		Modification			
		None			
APPLICATION	8. Type of System/Equipment	9. Life Cycle Phase	10. Functional Areas Supported		
	Total Ship	X	Concept Form.		
	Hull Structure		Validation		
	Propulsion		Development		
	Electric Plant		Acquisition		
	Command & Surv.		Operation		X
	Auxiliaries				
	Outfit/Furnish.				
Armament					
11. References (ARINC Research Corporation publications unless otherwise indicated)					
<p>1. A Recommended Procedure for Measuring and Assessing Ship Material Condition, Pub. 1613-01-1-1335, Nov. 1974</p>					

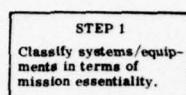
Continued

TECHNIQUE DESCRIPTION SHEET

1. Item No. 32 (Cont)	2. Title Measurement/Assessment of Ship Material Condition (Based on Quantity of Deferred Maintenance) (Cont)
---------------------------------	--

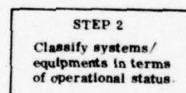
EIC	Nomenclature	CASREPT History			Mission Essential Item	Remarks
		Ship A	Ship B	Ship C		
1100	Hull Fittings					
1300	Canvas/Rigging					
1400	Ladders and Gratings					
1500	Bulkheads and Doors					
1600	Deck Covering					
1700	Hull Insulation and Sheathing					
1800	Staterooms/Bridge Lockers (Salvage Equip.)	X	X	X	e	Salvage Equipment

DATA COLLECTION

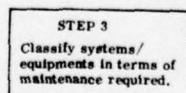


DATA SUMMARIZATION

EIC	Nomenclature	Operational Status			
		Inoper- ative	Reduced Capability	Degraded: No Mission Effect	No Degrada- tion
1100	Hull Fittings			X	
1300	Canvas/Rigging			X	
1400	Ladders & Gratings			X	
1800	Bulkheads and Doors			X	
1400	Deck Covering			X	
1700	Hull insulation and Sheathing			X	
1800	Storage Lids	X			



EIC	Nomenclature	Maintenance Required				
		Major	Moderate	Minor	Insig.	None
1100	Hull Fittings		X			
1300	Canvas/Rigging			X		
1400	Ladders and Gratings		X			
1500	Bulkheads and Doors		X			
1600	Deck Covering		X			
1700	Hull Insulation and Sheathing		X			
1800	Staterooms/Sewage					
1900	Lockers (Salvage Equip.)		X			
1900	Watertight Integrity and					



INOPERATIVE		REDUCED CAPABILITY		DEGRADED; NO MISSION EFFECT	
EIC	Nomenclature	EIC	Nomenclature	EIC	Nomenclature
T800	Firemain System	TF00	Compressed Air System	1500	Bulkhead and Doors
Major Maintenance	—	—	—	—	—
Moderate Maintenance	—	—	—	—	—
Minor Maintenance	—	—	—	—	—
Insignificant Maintenance	—	—	—	—	—
No Maintenance	—	—	—	—	—

SUMMARIZATION

DATA ANALYSIS

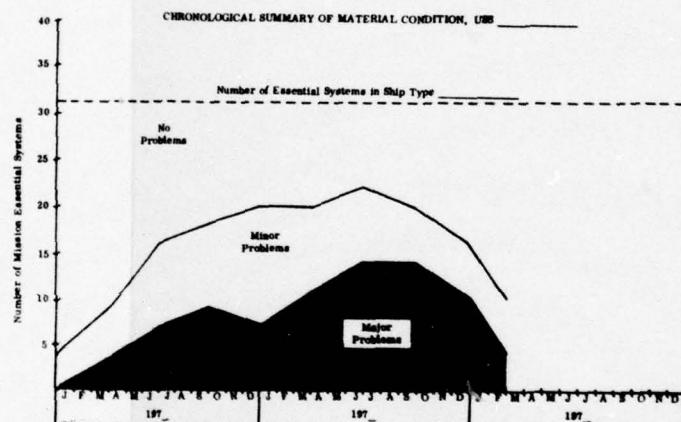
STEP 5
**Rank systems/
equipment in terms
of importance.**

STEP 4

STEP 6
Monitor material condition changes

STEP 7
Compare material condition against baseline.

A. Ranking Based on Extent of Maintenance Required to Restore			B. Ranking Based on Impact on Performance Capability		
Rank	EIC	System / Equipment	Rank	EIC	System / Equipment
1	T800	Firemain System	1	T800	Firemain System
2	TF00	Compressed Air System	2	TF00	Compressed Air System
3	S100	Ship Service Generators	3	S100	Ship Room Eq. (Salvage Gear)
	C100	Main Engines		Q100	Communication Transceivers
	T100	Heating Syst. (Aux. Boiler)		P100	Surface Search Radar
	V100	Ventilation System		S100	Ship Service Generators
	TM00	Deck Machinery		C100	Main Engines
8	I100	Storage Eq. (Salvage Gear)		T100	Heating Syst. (Aux. Boiler)
	Q100	Comm. Trans.			



Ship Type: ATT ARS		Date:		Mission Essential Systems/Equipment	
Ship	System	System	System	System	System
1.00	Ballistic Missile Defense	2.00	Countermeasures	3.00	Navigation
4.00	Flight Control	5.00	Power	6.00	Propulsion
7.00	Computer	8.00	Structures	9.00	Survival Equipment
10.00	Communication	11.00	Thermal Protection	12.00	Water
13.00	Orbital Maneuvering System	14.00	Heat Shield	15.00	Emergency
16.00	Reentry Interface	17.00	Guidance	18.00	Flight Control
19.00	Propulsion	20.00	Structures	21.00	Power
22.00	Computer	23.00	Communication	24.00	Navigation
25.00	Orbital Maneuvering System	26.00	Heat Shield	27.00	Emergency
28.00	Reentry Interface	29.00	Guidance	30.00	Flight Control
31.00	Propulsion	32.00	Structures	33.00	Power
34.00	Computer	35.00	Communication	36.00	Navigation
37.00	Orbital Maneuvering System	38.00	Heat Shield	39.00	Emergency
40.00	Reentry Interface	41.00	Guidance	42.00	Flight Control
43.00	Propulsion	44.00	Structures	45.00	Power
46.00	Computer	47.00	Communication	48.00	Navigation
49.00	Orbital Maneuvering System	50.00	Heat Shield	51.00	Emergency
52.00	Reentry Interface	53.00	Guidance	54.00	Flight Control
55.00	Propulsion	56.00	Structures	57.00	Power
58.00	Computer	59.00	Communication	60.00	Navigation
61.00	Orbital Maneuvering System	62.00	Heat Shield	63.00	Emergency
64.00	Reentry Interface	65.00	Guidance	66.00	Flight Control
67.00	Propulsion	68.00	Structures	69.00	Power
70.00	Computer	71.00	Communication	72.00	Navigation
73.00	Orbital Maneuvering System	74.00	Heat Shield	75.00	Emergency
76.00	Reentry Interface	77.00	Guidance	78.00	Flight Control
79.00	Propulsion	80.00	Structures	81.00	Power
82.00	Computer	83.00	Communication	84.00	Navigation
85.00	Orbital Maneuvering System	86.00	Heat Shield	87.00	Emergency
88.00	Reentry Interface	89.00	Guidance	90.00	Flight Control
91.00	Propulsion	92.00	Structures	93.00	Power
94.00	Computer	95.00	Communication	96.00	Navigation
97.00	Orbital Maneuvering System	98.00	Heat Shield	99.00	Emergency
100.00	Reentry Interface	101.00	Guidance	102.00	Flight Control
103.00	Propulsion	104.00	Structures	105.00	Power
106.00	Computer	107.00	Communication	108.00	Navigation
109.00	Orbital Maneuvering System	110.00	Heat Shield	111.00	Emergency
112.00	Reentry Interface	113.00	Guidance	114.00	Flight Control
115.00	Propulsion	116.00	Structures	117.00	Power
118.00	Computer	119.00	Communication	120.00	Navigation
121.00	Orbital Maneuvering System	122.00	Heat Shield	123.00	Emergency
124.00	Reentry Interface	125.00	Guidance	126.00	Flight Control
127.00	Propulsion	128.00	Structures	129.00	Power
130.00	Computer	131.00	Communication	132.00	Navigation
133.00	Orbital Maneuvering System	134.00	Heat Shield	135.00	Emergency
136.00	Reentry Interface	137.00	Guidance	138.00	Flight Control
139.00	Propulsion	140.00	Structures	141.00	Power
142.00	Computer	143.00	Communication	144.00	Navigation
145.00	Orbital Maneuvering System	146.00	Heat Shield	147.00	Emergency
148.00	Reentry Interface	149.00	Guidance	150.00	Flight Control
151.00	Propulsion	152.00	Structures	153.00	Power
154.00	Computer	155.00	Communication	156.00	Navigation
157.00	Orbital Maneuvering System	158.00	Heat Shield	159.00	Emergency
160.00	Reentry Interface	161.00	Guidance	162.00	Flight Control
163.00	Propulsion	164.00	Structures	165.00	Power
166.00	Computer	167.00	Communication	168.00	Navigation
169.00	Orbital Maneuvering System	170.00	Heat Shield	171.00	Emergency
172.00	Reentry Interface	173.00	Guidance	174.00	Flight Control
175.00	Propulsion	176.00	Structures	177.00	Power
178.00	Computer	179.00	Communication	180.00	Navigation
181.00	Orbital Maneuvering System	182.00	Heat Shield	183.00	Emergency
184.00	Reentry Interface	185.00	Guidance	186.00	Flight Control
187.00	Propulsion	188.00	Structures	189.00	Power
190.00	Computer	191.00	Communication	192.00	Navigation
193.00	Orbital Maneuvering System	194.00	Heat Shield	195.00	Emergency
196.00	Reentry Interface	197.00	Guidance	198.00	Flight Control
199.00	Propulsion	200.00	Structures	201.00	Power
202.00	Computer	203.00	Communication	204.00	Navigation
205.00	Orbital Maneuvering System	206.00	Heat Shield	207.00	Emergency
208.00	Reentry Interface	209.00	Guidance	210.00	Flight Control
211.00	Propulsion	212.00	Structures	213.00	Power
214.00	Computer	215.00	Communication	216.00	Navigation
217.00	Orbital Maneuvering System	218.00	Heat Shield	219.00	Emergency
220.00	Reentry Interface	221.00	Guidance	222.00	Flight Control
223.00	Propulsion	224.00	Structures	225.00	Power
226.00	Computer	227.00	Communication	228.00	Navigation
229.00	Orbital Maneuvering System	230.00	Heat Shield	231.00	Emergency
232.00	Reentry Interface	233.00	Guidance	234.00	Flight Control
235.00	Propulsion	236.00	Structures	237.00	Power
238.00	Computer	239.00	Communication	240.00	Navigation
241.00	Orbital Maneuvering System	242.00	Heat Shield	243.00	Emergency
244.00	Reentry Interface	245.00	Guidance	246.00	Flight Control
247.00	Propulsion	248.00	Structures	249.00	Power
250.00	Computer	251.00	Communication	252.00	Navigation
253.00	Orbital Maneuvering System	254.00	Heat Shield	255.00	Emergency
256.00	Reentry Interface	257.00	Guidance	258.00	Flight Control
259.00	Propulsion	260.00	Structures	261.00	Power
262.00	Computer	263.00	Communication	264.00	Navigation
265.00	Orbital Maneuvering System	266.00	Heat Shield	267.00	Emergency
268.00	Reentry Interface	269.00	Guidance	270.00	Flight Control
271.00	Propulsion	272.00	Structures	273.00	Power
274.00	Computer	275.00	Communication	276.00	Navigation
277.00	Orbital Maneuvering System	278.00	Heat Shield	279.00	Emergency
280.00	Reentry Interface	281.00	Guidance	282.00	Flight Control
283.00	Propulsion	284.00	Structures	285.00	Power
286.00	Computer	287.00	Communication	288.00	Navigation
289.00	Orbital Maneuvering System	290.00	Heat Shield	291.00	Emergency
292.00	Reentry Interface	293.00	Guidance	294.00	Flight Control
295.00	Propulsion	296.00	Structures	297.00	Power
298.00	Computer	299.00	Communication	300.00	Navigation
301.00	Orbital Maneuvering System	302.00	Heat Shield	303.00	Emergency
304.00	Reentry Interface	305.00	Guidance	306.00	Flight Control
307.00	Propulsion	308.00	Structures	309.00	Power
310.00	Computer	311.00	Communication	312.00	Navigation
313.00	Orbital Maneuvering System	314.00	Heat Shield	315.00	Emergency
316.00	Reentry Interface	317.00	Guidance	318.00	Flight Control
319.00	Propulsion	320.00	Structures	321.00	Power
322.00	Computer	323.00	Communication	324.00	Navigation
325.00	Orbital Maneuvering System	326.00	Heat Shield	327.00	Emergency
328.00	Reentry Interface	329.00	Guidance	330.00	Flight Control
331.00	Propulsion	332.00	Structures	333.00	Power
334.00	Computer	335.00	Communication	336.00	Navigation
337.00	Orbital Maneuvering System	338.00	Heat Shield	339.00	Emergency
340.00	Reentry Interface	341.00	Guidance	342.00	Flight Control
343.00	Propulsion	344.00	Structures	345.00	Power
346.00	Computer	347.00	Communication	348.00	Navigation
349.00	Orbital Maneuvering System	350.00	Heat Shield	351.00	Emergency
352.00	Reentry Interface	353.00	Guidance	354.00	Flight Control
355.00	Propulsion	356.00	Structures	357.00	Power
358.00	Computer	359.00	Communication	360.00	Navigation
361.00	Orbital Maneuvering System	362.00	Heat Shield	363.00	Emergency
364.00	Reentry Interface	365.00	Guidance	366.00	Flight Control
367.00	Propulsion	368.00	Structures	369.00	Power
370.00	Computer	371.00	Communication	372.00	Navigation
373.00	Orbital Maneuvering System	374.00	Heat Shield	375.00	Emergency
376.00	Reentry Interface	377.00	Guidance	378.00	Flight Control
379.00	Propulsion	380.00	Structures	381.00	Power
382.00	Computer	383.00	Communication	384.00	Navigation
385.00	Orbital Maneuvering System	386.00	Heat Shield	387.00	Emergency
388.00	Reentry Interface	389.00	Guidance	390.00	Flight Control
391.00	Propulsion	392.00	Structures	393.00	Power
394.00	Computer	395.00	Communication	396.00	Navigation
397.00	Orbital Maneuvering System	398.00	Heat Shield	399.00	Emergency
400.00	Reentry Interface	401.00	Guidance	402.00	Flight Control
403.00	Propulsion	404.00	Structures	405.00	Power
406.00	Computer	407.00	Communication	408.00	Navigation
409.00	Orbital Maneuvering System	410.00	Heat Shield	411.00	Emergency
412.00	Reentry Interface	413.00	Guidance	414.00	Flight Control
415.00	Propulsion	416.00	Structures	417.00	Power
418.00	Computer	419.00	Communication	420.00	Navigation
421.00	Orbital Maneuvering System	422.00	Heat Shield	423.00	Emergency
424.00	Reentry Interface	425.00	Guidance	426.00	Flight Control
427.00	Propulsion	428.00	Structures	429.00	Power
430.00	Computer	431.00	Communication	432.00	Navigation
433.00	Orbital Maneuvering System	434.00	Heat Shield	435.00	Emergency
436.00	Reentry Interface	437.00	Guidance	438.00	Flight Control
439.00	Propulsion	440.00	Structures	441.00	Power
442.00	Computer	443.00	Communication	444.00	Navigation
445.00	Orbital Maneuvering System	446.00	Heat Shield	447.00	Emergency
448.00	Reentry Interface	449.00	Guidance	450.00	Flight Control
451.00	Propulsion	452.00	Structures	453.00	Power
454.00	Computer	455.00	Communication	456.00	Navigation
457.00	Orbital Maneuvering System	458.00	Heat Shield	459.00	Emergency
460.00	Reentry Interface	461.00	Guidance	462.00	Flight Control
463.00	Propulsion	464.00	Structures	465.00	Power
466.00	Computer	467.00	Communication	468.00	Navigation
469.00	Orbital Maneuvering System	470.00	Heat Shield	471.00	Emergency
472.00	Reentry Interface	473.00	Guidance	474.00	Flight Control
475.00	Propulsion	476.00	Structures	477.00	Power
478.00	Computer	479.00	Communication	480.00	Navigation
481.00	Orbital Maneuvering System	482.00	Heat Shield	483.00	Emergency
484.00	Reentry Interface	485.00	Guidance	486.00	Flight Control
487.00	Propulsion	488.00	Structures	489.00	Power
490.00	Computer	491.00	Communication	492.00	Navigation
493.00	Orbital Maneuvering System	494.00	Heat Shield	495.00	Emergency
496.00	Reentry Interface	497.00	Guidance	498.00	Flight Control
499.00	Propulsion	500.00	Structures	501.00	Power

Type	Total	No. Shape in Cat. A	No. Shape in Cat. B	No. Shape in Cat. C	No. Shape in Cat. D	No. of shapes in Cat. A, B, C, or D
1	100	10	10	10	10	40
2	100	10	10	10	10	40
3	100	10	10	10	10	40
4	100	10	10	10	10	40
5	100	10	10	10	10	40
6	100	10	10	10	10	40
7	100	10	10	10	10	40
8	100	10	10	10	10	40
9	100	10	10	10	10	40
10	100	10	10	10	10	40
11	100	10	10	10	10	40
12	100	10	10	10	10	40
13	100	10	10	10	10	40
14	100	10	10	10	10	40
15	100	10	10	10	10	40
16	100	10	10	10	10	40
17	100	10	10	10	10	40
18	100	10	10	10	10	40
19	100	10	10	10	10	40
20	100	10	10	10	10	40
21	100	10	10	10	10	40
22	100	10	10	10	10	40
23	100	10	10	10	10	40
24	100	10	10	10	10	40
25	100	10	10	10	10	40
26	100	10	10	10	10	40
27	100	10	10	10	10	40
28	100	10	10	10	10	40
29	100	10	10	10	10	40
30	100	10	10	10	10	40
31	100	10	10	10	10	40
32	100	10	10	10	10	40
33	100	10	10	10	10	40
34	100	10	10	10	10	40
35	100	10	10	10	10	40
36	100	10	10	10	10	40
37	100	10	10	10	10	40
38	100	10	10	10	10	40
39	100	10	10	10	10	40
40	100	10	10	10	10	40
41	100	10	10	10	10	40
42	100	10	10	10	10	40
43	100	10	10	10	10	40
44	100	10	10	10	10	40
45	100	10	10	10	10	40
46	100	10	10	10	10	40
47	100	10	10	10	10	40
48	100	10	10	10	10	40
49	100	10	10	10	10	40
50	100	10	10	10	10	40
51	100	10	10	10	10	40
52	100	10	10	10	10	40
53	100	10	10	10	10	40
54	100	10	10	10	10	40
55	100	10	10	10	10	40
56	100	10	10	10	10	40
57	100	10	10	10	10	40
58	100	10	10	10	10	40
59	100	10	10	10	10	40
60	100	10	10	10	10	40
61	100	10	10	10	10	40
62	100	10	10	10	10	40
63	100	10	10	10	10	40
64	100	10	10	10	10	40
65	100	10	10	10	10	40
66	100	10	10	10	10	40
67	100	10	10	10	10	40
68	100	10	10	10	10	40
69	100	10	10	10	10	40
70	100	10	10	10	10	40
71	100	10	10	10	10	40
72	100	10	10	10	10	40
73	100	10	10	10	10	40
74	100	10	10	10	10	40
75	100	10	10	10	10	40
76	100	10	10	10	10	40
77	100	10	10	10	10	40
78	100	10	10	10	10	40
79	100	10	10	10	10	40
80	100	10	10	10	10	40
81	100	10	10	10	10	40
82	100	10	10	10	10	40
83	100	10	10	10	10	40
84	100	10	10	10	10	40
85	100	10	10	10	10	40
86	100	10	10	10	10	40
87	100	10	10	10	10	40
88	100	10	10	10	10	40
89	100	10	10	10	10	40
90	100	10	10	10	10	40
91	100	10	10	10	10	40
92	100	10	10	10	10	40
93	100	10	10	10	10	40
94	100	10	10	10	10	40
95	100	10	10	10	10	40
96	100	10	10	10	10	40
97	100	10	10	10	10	40
98	100	10	10	10	10	40
99	100	10	10	10	10	40
100	100	10	10	10	10	40

Category Definitions

- Category A - System equipment contains inoperative material; major corrective maintenance required
- Category B - System equipment contains reduced capability material; major corrective maintenance required
- Category C - System equipment contains inoperative material; moderate corrective maintenance required
- Category D - System equipment contains reduced capability material; moderate corrective maintenance required

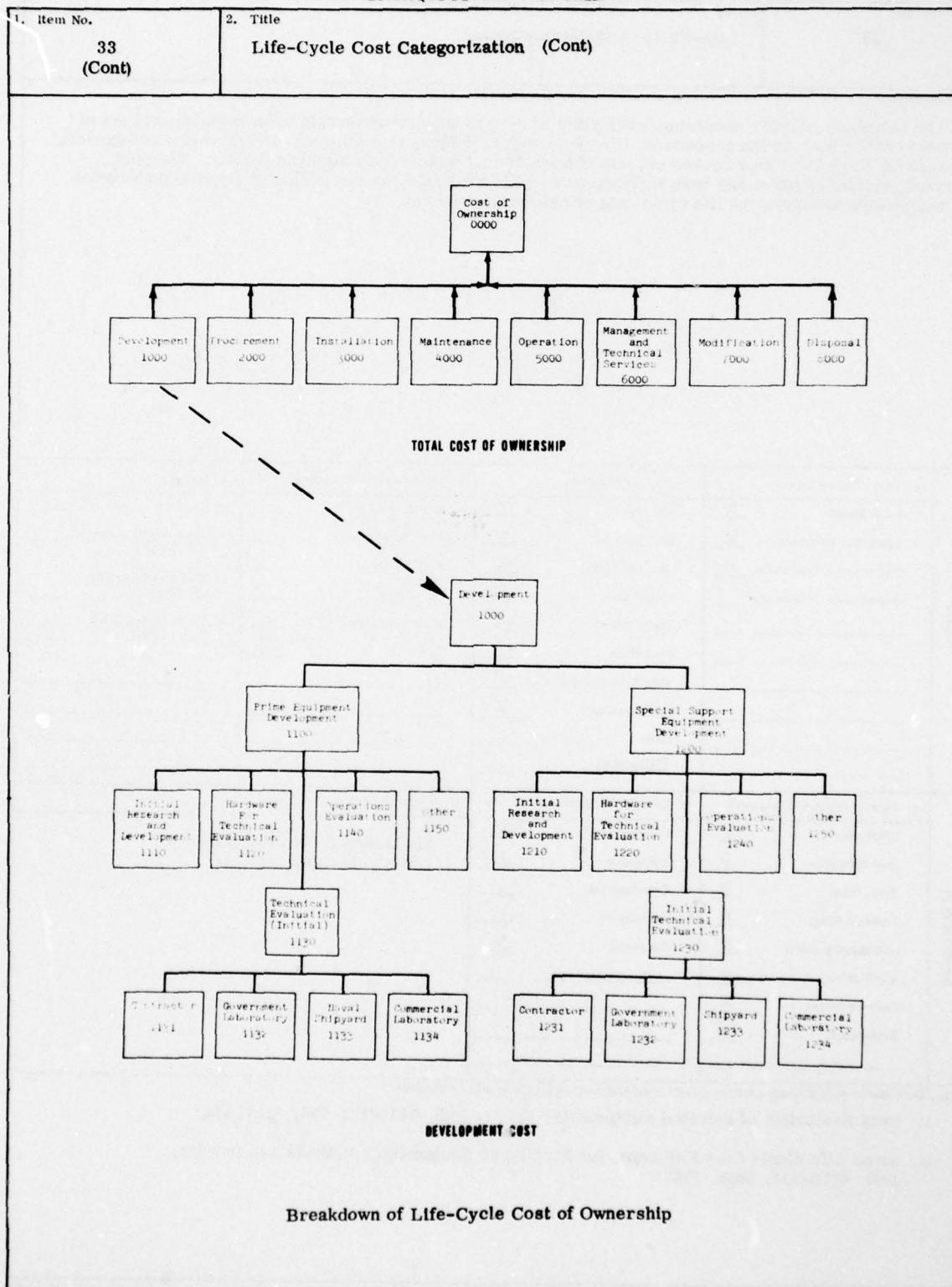
Procedure for Measuring/ Assessing Material Condition

TECHNIQUE DESCRIPTION SHEET

1. Item No. 33	2. Title Life-Cycle Cost Categorization			
3. Description The technique permits assessing/estimating life-cycle cost-of-ownership using a structured set of cost categories. In the procedure, life cycle cost is defined as consisting of eight major categories, each of which is further broken out into elemental cost factors (see attached figure). The cost categorization system has been applied, using historical data, to a sampling of shipboard electronic equipments to determine life cycle cost of ownership (see ref. 1).				
DESIGN	4. Type of Technique	5. Cost Parameters	6. Effectiveness Parameters	7. Status
	Math Model <input checked="" type="checkbox"/>	Life Cycle <input checked="" type="checkbox"/>	Effectiveness <input type="checkbox"/>	Concept <input type="checkbox"/>
	Computer Program <input checked="" type="checkbox"/>	Development <input checked="" type="checkbox"/>	Perf. Capability <input type="checkbox"/>	Technique Developed, Not Applied <input type="checkbox"/>
	Engineering Procedure <input checked="" type="checkbox"/>	Procurement <input checked="" type="checkbox"/>	Availability <input type="checkbox"/>	
	Management Procedure <input type="checkbox"/>	Installation <input checked="" type="checkbox"/>	Reliability <input type="checkbox"/>	Technique Applied One Time <input type="checkbox"/>
	<input type="checkbox"/>	Maintenance <input checked="" type="checkbox"/>	Maintainability <input type="checkbox"/>	Technique Applied Recurrently <input checked="" type="checkbox"/>
	<input type="checkbox"/>	Operation <input checked="" type="checkbox"/>	None <input checked="" type="checkbox"/>	<input type="checkbox"/>
	<input type="checkbox"/>	Mgt/Tech Service <input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
	<input type="checkbox"/>	Modification <input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
	<input type="checkbox"/>	None <input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
APPLICATION	8. Type of System/Equipment	9. Life Cycle Phase	10. Functional Areas Supported	
	Total Ship <input type="checkbox"/>	Concept Form. <input type="checkbox"/>	Maintenance Cost Analysis	
	Hull Structure <input type="checkbox"/>	Validation <input type="checkbox"/>	Life Cycle Cost Analysis	
	Propulsion <input type="checkbox"/>	Development <input type="checkbox"/>		
	Electric Plant <input type="checkbox"/>	Acquisition <input type="checkbox"/>		
	Command & Surv. <input checked="" type="checkbox"/>	Operation <input checked="" type="checkbox"/>		
	Auxiliaries <input type="checkbox"/>	<input type="checkbox"/>		
	Outfit/Furnish. <input type="checkbox"/>	<input type="checkbox"/>		
Armament <input type="checkbox"/>	<input type="checkbox"/>			
11. References (ARINC Research Corporation publications unless otherwise indicated)				
1. Cost Evaluation of Selected Equipments, Vol. I, Pub. 541-01-1-766, April 1967				
2. Some Life-Cycle Cost Estimates for Electronic Equipments; Methods and Results, Pub. 4670-824, Sept. 1967				

Continued

TECHNIQUE DESCRIPTION SHEET

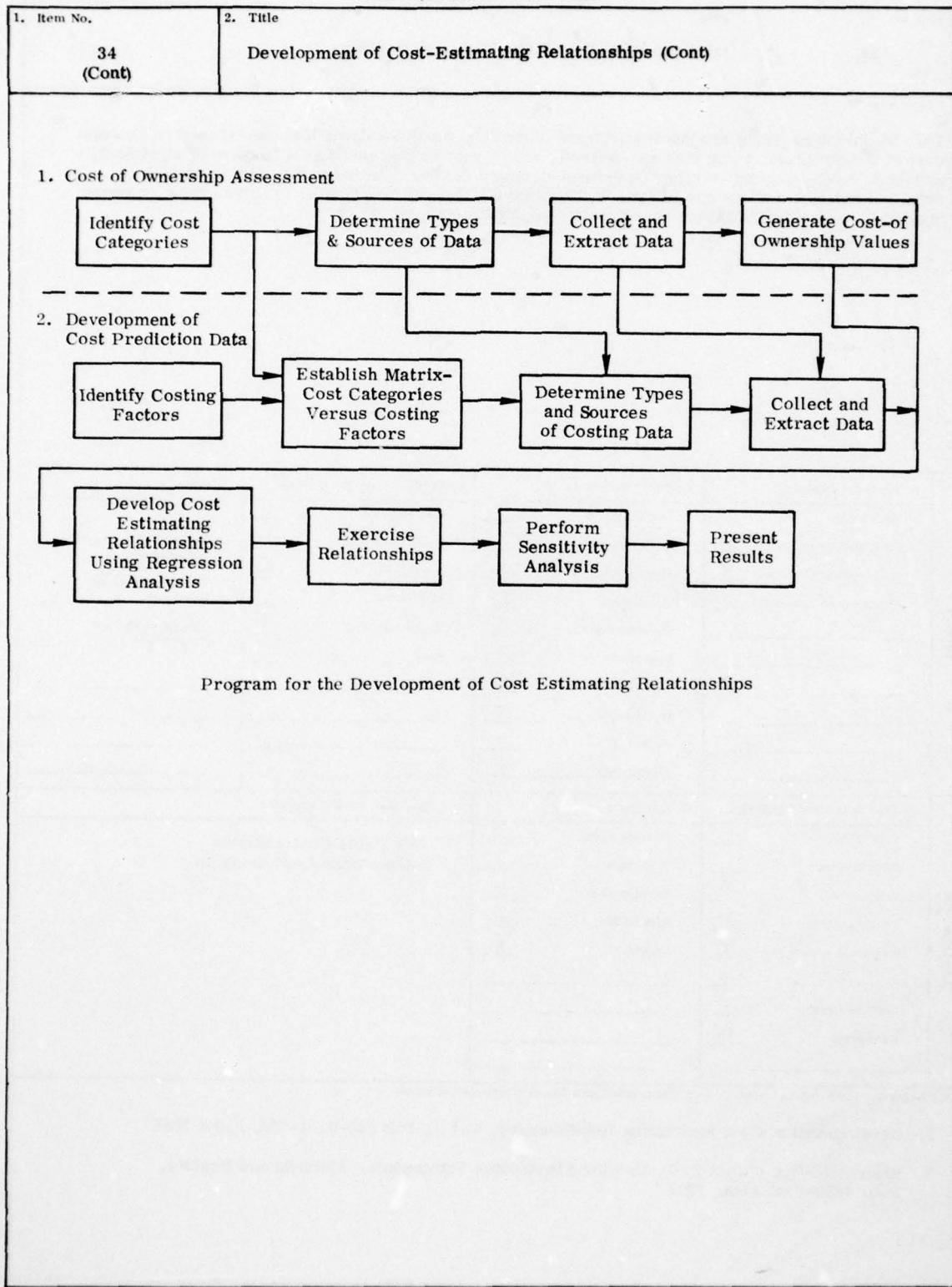


TECHNIQUE DESCRIPTION SHEET

1. Item No.	2. Title					
34	Development of Cost-Estimating Relationships					
3. Description						
<p>This technique provides for the development of mathematical equations that can be used to forecast cost of ownership (or some element thereof), where cost is expressed as a function of electrical, physical, environmental or other equipment-oriented factor. The procedure for developing cost-estimating relationships (CERs) is illustrated in the attached figure. The technique has been applied to a sampling shipboard electronic equipments (see ref. 1)</p>						
DESIGN	4. Type of Technique		5. Cost Parameters	6. Effectiveness Parameters	7. Status	
	Math Model	<input checked="" type="checkbox"/>	Life Cycle	<input checked="" type="checkbox"/>	Effectiveness	—
	Computer Program	<input checked="" type="checkbox"/>	Development	<input checked="" type="checkbox"/>	Perf. Capability	—
	Engineering Procedure	<input checked="" type="checkbox"/>	Procurement	<input checked="" type="checkbox"/>	Availability	<input checked="" type="checkbox"/>
	Management Procedure	—	Installation	<input checked="" type="checkbox"/>	Reliability	<input checked="" type="checkbox"/>
		—	Maintenance	<input checked="" type="checkbox"/>	Maintainability	<input checked="" type="checkbox"/>
		—	Operation	<input checked="" type="checkbox"/>	None	—
		—	Mgt/Tech Service	<input checked="" type="checkbox"/>		—
		—	Modification	<input checked="" type="checkbox"/>		—
		—	None	—		—
	Disposal	<input checked="" type="checkbox"/>			—	
APPLICATION	8. Type of System/Equipment		9. Life Cycle Phase		10. Functional Areas Supported	
	Total Ship	—	Concept Form.	<input checked="" type="checkbox"/>	Life Cycle Cost Analysis	
	Hull Structure	—	Validation	<input checked="" type="checkbox"/>	Maintenance Cost Analysis	
	Propulsion	<input checked="" type="checkbox"/>	Development	<input checked="" type="checkbox"/>		
	Electric Plant	<input checked="" type="checkbox"/>	Acquisition	<input checked="" type="checkbox"/>		
	Command & Surv.	<input checked="" type="checkbox"/>	Operation	<input checked="" type="checkbox"/>		
	Auxiliaries	<input checked="" type="checkbox"/>		—		
	Outfit/Furnish.	<input checked="" type="checkbox"/>		—		
	Armament	<input checked="" type="checkbox"/>		—		
11. References (ARINC Research Corporation publications unless otherwise indicated)						
<ol style="list-style-type: none"> 1. Development of Cost Estimating Relationships, Vol II, Pub 540-01-1-766, April 1967 2. Some Life-Cycle Cost Estimates for Electronics Equipments: Methods and Results, Pub. 4670-824, Sept. 1967 						

Continued

TECHNIQUE DESCRIPTION SHEET



TECHNIQUE DESCRIPTION SHEET

1. Item No.	2. Title			
35	Determination of Annualized Maintenance Cost for Ships			
3. Description				
<p>This procedure involves the collection of data and performance of calculations as necessary to compute the annual cost of maintenance for Navy ships. The specific categories of cost included in the calculation are summarized on the attached sheet. The procedure has been applied to selected destroyer classes (see ref. 1) incident to feasibility studies for extending their overhaul cycles.</p>				
DESIGN	4. Type of Technique	5. Cost Parameters	6. Effectiveness Parameters	7. Status
	Math Model	Life Cycle	Effectiveness	Concept
	Computer Program	Development	Perf. Capability	Technique Developed, Not Applied
	Engineering Procedure X	Procurement	Availability	
	Management Procedure	Installation	Reliability	Technique Applied One Time
		Maintenance	X Maintainability	Technique Applied Recurrently
		Operation	None X	
		Mgt/Tech Service		
		Modification		
APPLICATION	8. Type of System/Equipment	9. Life Cycle Phase	10. Functional Areas Supported	
	Total Ship X	Concept Form.	Maintenance Budgeting	
	Hull Structure	Validation	Maintenance Cost Analysis	
	Propulsion	Development	Maintenance Strategy Planning	
	Electric Plant	Acquisition		
	Command & Surv.	Operation X		
	Auxiliaries			
	Outfit/Furnish.			
	Armament			
11. References (ARINC Research Corporation publications unless otherwise indicated)				
1. A Study to Determine the Annualized Maintenance Cost and Feasibility of Adopting an Extended Overhaul Cycle for Destroyer-Type Ships, Pub. 1024-01-1-1293, March 1974				

Continued

TECHNIQUE DESCRIPTION SHEET

1. Item No.	2. Title
35 (Cont)	Determination of Annualized Maintenance Cost for Ships (Cont)
ITEMS INCLUDED IN COMPUTATION OF ANNUALIZED MAINTENANCE COST	
<ul style="list-style-type: none">a. <u>Overhaul Cost</u> - That charged during overhaul for repair.b. <u>Ship's Force/Tender Material Cost</u> - That expended by the ship's force/tender for material used in corrective maintenance.c. <u>Restricted Availability Cost</u> - That expended by type commanders in restricted availabilities. Return costs (i.e., costs actually incurred versus costs paid by the TYCOMs) are used when available.d. <u>Technical Availability Cost</u> - That expended by the TYCOMs in technical availabilities. Return costs are used when available.e. <u>Miscellaneous Technical Availability Cost</u> - That expended by the TYCOMs for miscellaneous technical availabilities. Return costs are used when available.f. <u>In-Voyage Repair Cost</u> - That expended by the TYCOMs for repairs incurred while ships are en route to an operational commitment. Return costs are used when available.g. <u>Ship Repair Facility Cost</u> - That expended by CINCPACFLT in availabilities at the SRFs.h. <u>DATC Cost</u> - That associated with the manpower expended by the Development and Training Center, as reported in the Maintenance Data Collection System.i. <u>Ship's Force/Tender Labor Cost</u> - A fixed man-hour cost for the base year, which includes ship's force man-hours.	

TECHNIQUE DESCRIPTION SHEET

1. Item No.	2. Title			
36	Evaluating Feasibility of Extending Overhaul Interval			
3. Description				
<p>This procedure includes the steps necessary to evaluate the feasibility of extending the overhaul interval of ships. The steps in the procedure are described in ref. 1, para 3.3. The procedure has been used in evaluating the feasibility of extending the overhaul cycle for a variety of destroyers (see ref. 1).</p>				
DESIGN	4. Type of Technique	5. Cost Parameters	6. Effectiveness Parameters	7. Status
	Math Model <input checked="" type="checkbox"/>	Life Cycle _____	Effectiveness _____	Concept _____
	Computer Program _____	Development _____	Perf. Capability _____	Technique Developed, Not Applied _____
	Engineering Procedure <input checked="" type="checkbox"/>	Procurement _____	Availability _____	Technique Applied One Time _____
	Management Procedure _____	Installation _____	Reliability _____	Technique Applied Recurrently <input checked="" type="checkbox"/> _____
	_____	Maintenance <input checked="" type="checkbox"/>	Maintainability _____	_____
	_____	Operation _____	None <input checked="" type="checkbox"/>	_____
	_____	Mgt/Tech Service _____	_____	_____
	_____	Modification _____	_____	_____
	_____	None _____	_____	_____
APPLICATION	8. Type of System/Equipment	9. Life Cycle Phase	10. Functional Areas Supported	
	Total Ship <input checked="" type="checkbox"/>	Concept Form. _____	Maintenance Strategy Planning	
	Hull Structure _____	Validation _____	EOC Maintenance Management	
	Propulsion _____	Development _____		
	Electric Plant _____	Acquisition _____		
	Command & Surv. _____	Operation <input checked="" type="checkbox"/>		
	Auxiliaries _____	_____		
	Outfit/Furnish. _____	_____		
	Armament _____	_____		
11. References (ARINC Research Corporation publications unless otherwise indicated)				
<p>1. A Study to Determine the Annualized Maintenance Cost and Feasibility of Adopting an Extended Overhaul Cycle for Destroyer-Type Ships, Pub. 1024-01-1-1293, March 1974</p>				

TECHNIQUE DESCRIPTION SHEET

1. Item No.	2. Title		
37	Extended Operating Cycle Program Planning		
3. Description			
<p>A technique for planning an Extended Operating Cycle (EOC) program is currently being developed and applied to the EOC program for DD-class ships. The approach consists of a definitive set of actions which include a variety of management tasks including: identification and scheduling of the program elements; defining resource requirements; identification of major milestones; formulation of a management program; and a number of supportive tasks.</p>			
DESIGN	4. Type of Technique	5. Cost Parameters	6. Effectiveness Parameters
	Math Model	Life Cycle <input checked="" type="checkbox"/>	Effectiveness <input type="checkbox"/>
	Computer Program	Development <input type="checkbox"/>	Perf. Capability <input type="checkbox"/>
	Engineering Procedure	Procurement <input type="checkbox"/>	Availability <input checked="" type="checkbox"/>
	Management Procedure <input checked="" type="checkbox"/>	Installation <input type="checkbox"/>	Reliability <input checked="" type="checkbox"/>
		Maintenance <input type="checkbox"/>	Maintainability <input checked="" type="checkbox"/>
		Operation <input type="checkbox"/>	None <input type="checkbox"/>
		Mgt./Tech Service <input type="checkbox"/>	
		Modification <input type="checkbox"/>	
APPLICATION	8. Type of System/Equipment	9. Life Cycle Phase	10. Functional Areas Supported
	Total Ship <input checked="" type="checkbox"/>	Concept Form. <input type="checkbox"/>	EOC Maintenance Management
	Hull Structure <input type="checkbox"/>	Validation <input type="checkbox"/>	
	Propulsion <input type="checkbox"/>	Development <input type="checkbox"/>	
	Electric Plant <input type="checkbox"/>	Acquisition <input type="checkbox"/>	
	Command & Surv. <input type="checkbox"/>	Operation <input checked="" type="checkbox"/>	
	Auxiliaries <input type="checkbox"/>		
	Outfit/Furnish. <input type="checkbox"/>		
	Armament <input type="checkbox"/>		
11. References (ARINC Research Corporation publications unless otherwise indicated)			
<ol style="list-style-type: none"> 1. A Study to Determine the Annualized Maintenance Cost and Feasibility of Adopting an Extended Overhaul Cycle for Destroyer-Type Ships, Pub. 1024-01-1-1293, March 1974 2. Destroyer Extended Operating Cycle (EOC) Program Requirements, Pub. 1229-01-1-1358, Jan. 1975 			

TECHNIQUE DESCRIPTION SHEET

1. Item No.	2. Title		
38	Extended Operating Cycle Systems Analysis		
3. Description			
<p>EOC systems analysis is an engineering process that evaluates the design and experience of a selected ship system and develops an overhaul maintenance plan for the item. Outputs of the process are compiled in an system maintenance plan, which contains:</p> <ul style="list-style-type: none"> a. A concise statement of the system maintenance concept b. A summary of major maintenance actions, or maintenance profile (as illustrated in the attached Figure 1) c. A detailed tabulation of maintenance requirements (as illustrated in Figure 2) d. A statement of material condition standards e. A description of material condition assessment requirements 			
<p>The technique is applicable to any ship system/equipment.</p>			
DESIGN	4. Type of Technique	5. Cost Parameters	6. Effectiveness Parameters
	Math Model	Life Cycle	Effectiveness
	Computer Program	Development	Perf. Capability <input checked="" type="checkbox"/>
	Engineering Procedure <input checked="" type="checkbox"/>	Procurement	Availability
	Management Procedure	Installation	Reliability <input checked="" type="checkbox"/>
		Maintenance <input checked="" type="checkbox"/>	Maintainability <input checked="" type="checkbox"/>
		Operation	None
		Mgt/Tech Service	
		Modification	
		None	
APPLICATION	8. Type of System/Equipment	9. Life Cycle Phase	10. Functional Areas Supported
	Total Ship	Concept Form.	Maintenance Engineering Analysis
	Hull Structure <input checked="" type="checkbox"/>	Validation <input checked="" type="checkbox"/>	ROH Planning
	Propulsion <input checked="" type="checkbox"/>	Development <input checked="" type="checkbox"/>	SFOMS
	Electric Plant <input checked="" type="checkbox"/>	Acquisition <input checked="" type="checkbox"/>	Maintainability Prediction
	Command & Surv. <input checked="" type="checkbox"/>	Operation <input checked="" type="checkbox"/>	Reliability Prediction
	Auxiliaries <input checked="" type="checkbox"/>		EOC Maintenance Management
	Outfit/Furnish. <input checked="" type="checkbox"/>		ROH Work Package Development
	Armament <input checked="" type="checkbox"/>		
11. References (ARINC Research Corporation publications unless otherwise indicated)			
<ol style="list-style-type: none"> 1. EOC Systems Analysis Process, Informal Report, Aug. 1975 (Copies available from Ships and Ordnance Division) 2. System Maintenance Plan for 12000 GPD Distilling System, FF-1052 Class, Informal Report, Aug. 1975 (Copies available from Ships and Ordnance Division) 			

Continued

TECHNIQUE DESCRIPTION SHEET

1. Item No.		2. Title					
38 (Cont)		Extended Operating Cycle Systems Available (Cont)					
MAINTENANCE PROFILE			CLASS FF-1052	-26CX SONAR	SWBS 463	CONTROL NUMBER 4631-301	PAGE NUMBER 1 OF 5
OPERATING PROFILE	QUARTER AFTER BOH	EQUIPMENT COMPONENT					
WORK-UP	1	SONAR SIGNAL PROCESSING AND RECEIVING AND TRANSDUCER	SONAR DOME PRESSURIZATION	SONAR POWER SUPPLY	ANTICIPATED ON CONDITION MAINTENANCE, SONAR, DOME, LAPS	TOTAL MAINTENANCE BURDEN (Man-Hours unless noted otherwise)	
	2	S-W1-0-1 (X12) S-M1-0-1,2 (X2) S-M2-0-,2 (X2)	D-D1-0-,3 (X90) D-W1-0-1,6 (X12) D-N1-0-1,6 (X2) D-M2-0-1 (X2) D-M3-0-1 (X2) D-M4-0-1 (X2)	.1 (X2) 1.5 (X2) 1.2 (X2) .6 (X3)	S-R1-0-1 (X3) S-R2W-0-1 (X3) S-R3-0-,5 (X2)	ORG 77.6	7.0
	3	S-W1-0-1 (X13) S-M1-0-1,2 (X3) S-M2-0-,2 (X3) S-Q1R (a-j)-0-20,3 S-Q2R (a-c)-0-10,5 S-Q3-0-,4 S-Q4-0-3 S-Q5-0-8 S-Q6-0-24 S-Q7-0-4 S-Q8-0-2 S-Q9-0-2 S-Q10-0-9	D-D1-0-,3 (X90) D-W1-0-1,6 (X13) D-M1-0-1,6 (X3) D-M2-0-1 (X3) D-M3-0-1 (X3) D-M4-0-1 (X3) D-Q1-0-,8	.1 (X3) 1.5 (X3) 1.2 (X3) 0-.6 (X4) 0-7 6 .5	S-09-0-1 S-016-0-6 S-08-0-1 S-011-0-2 S-04-0-4,5 S-R1-0-1 (X8) S-R2W-0-1 (X12) S-R3-0-,5 (X4)	ORG 187.1	38.5
		S-W1-0-1 (X13) S-M1-0-1,2 (X3) S-M2-0-,2 (X3) S-Q1R (a-c)-0-20,3 S-Q2R (a-c)-0-10,5 S-Q3-0-,4 S-Q4-0-3 S-Q5-0-8 S-Q6-0-24 S-Q7-0-4 S-Q8-0-2 S-Q9-0-2 S-Q10-0-9 S-S1-0-,5 S-S2-0-,5 S-S3-0-1	D-D1-0-,3 (X90) D-W1-0-1,6 (X13) D-M1-0-1,6 (X3) D-M2-0-1 (X3) D-M3-0-1 (X3) D-M4-0-1 (X3) D-Q1-0-,8 D-S1-1-16	1 (X3) .5 (X3) 1.2 (X3) 1.6 (X2) 7 6 .5 8 1.6	S-09-0-1 S-010-0-4 S-017-0-4 S-012-0-4 S-08-0-1 S-011-0-1 S-04-0-4,5 S-013-0-10,5 S-R1-0-1 (X1) S-R2W-0-1 (X2) S-R3-0-,5 (X2)	ORG 198.7	34.0
		S-W1-0-1 (X13) S-M1-0-1,2 (X3) S-M2-0-,2 (X3) S-Q1R (a-c)-0-20,3	D-D1-0-,3 (X90) D-W1-0-1,6 (X13) D-M1-0-1,6 (X3)	L-1 (X3) L-1 (X3) L-1 (X3)	S-09-0-1 (X2) S-014-0-8,4 S-013-0-3	IMA 16.0	

Figure 1. Example of Maintenance Profile Summary

Code	Maintenance Action	Condition Monitoring Action	Burden	Frequency	Condition Threshold
2.0.W.1	Turn pump by hand/power	None	0.1	Weekly	
2.0.M.1		Inspect packing gland adjustment	0.3	Monthly	
2.0.0.1	Renew packing	See Code 2.0.M.1	2.0	Conditional (Est: Semi-annually)	Accomplish when measured distance between packing gland and pump housing is less than 1/4 inch
2.0.S.1		Check shutoff head pressure	0.2	Semi-annually	
2.0.0.2	Inspect pump internals and replace worn parts	See Code 2.0.S.1	15.0	Conditional	Accomplish when shutoff head pressure measurement is less than 23 psig (75% of 30 psig)

Figure 2. Example of Maintenance Requirements Tabulation

TECHNIQUE DESCRIPTION SHEET

1. Item No.	2. Title			
39	Class-Level Critical Equipment List Development			
3. Description				
<p>This technique consists of the development of a ship class-level ranked equipment list based on the following factors:</p> <ul style="list-style-type: none"> a. Maintenance burden b. CASREPT frequency c. Mission criticality <p>The objective of the technique is to provide visibility for establishing work priorities in the maintenance program. The technique is based on utilization of a variety of source data, including CASREPTs, MDCS, and baseline repair profiles. The technique has been applied to the FF-1052 class, with the results partially illustrated by the attached figure. The technique can be applied to any ship class for which source data are available.</p>				
DESIGN	4. Type of Technique	5. Cost Parameters	6. Effectiveness Parameters	7. Status
	Math Model	Life Cycle	Effectiveness	Concept
	Computer Program	Development	Perf. Capability	Technique Developed, Not Applied
	Engineering Procedure X	Procurement	Availability	
	Management Procedure	Installation	Reliability	X
		Maintenance	Maintainability	X
		Operation	None	
		Mgt/Tech Service		
		Modification		
		None		
APPLICATION	8. Type of System/Equipment	9. Life Cycle Phase	10. Functional Areas Supported	
	Total Ship	Concept Form.	EOC Maintenance Management	
	Hull Structure X	Validation	Maintainability Measurement	
	Propulsion X	Development	Reliability Measurement	
	Electric Plant X	Acquisition	ROH Planning	
	Command & Surv. X	Operation	Ships Systems/Equipment Criticality Ranking	
	Auxiliaries X			
	Outfit/Furnish. X			
	Armament X			
	FF-1052 X			
11. References (ARINC Research Corporation publications unless otherwise indicated)				
<ol style="list-style-type: none"> 1. FF-1052 Class Critical Equipment List Development, Informal Report, Aug. 1975 (copies available from Ships and Ordnance Division) 				

Continued

TECHNIQUE DESCRIPTION SHEET

1. Item No. 39 (Cont)	2. Title Class-Level Critical Equipment List Development (Cont)					
FF 1052 CLASS CRITICAL EQUIPMENT LIST MAINTENANCE BURDEN FACTOR ORDER						
Equipment Nomenclature	SSDI	MBF Rank	Total MDCS	No. of CASREPTS	Overhaul Freq. %	Mission Critical
Main Boiler	2211	1	14.829	218	100	X
AN/WLR-1C (E.C.M.)	4721	2	2.389	155	100	X
Main Feed Pump	2551	3	3.387	106	90	X
ASROC Launcher	7211	4	2.525	102	90	X
SSTG Sets	3111	5	2.592	57	100	X
Forced Draft Blowers	2511	6	3.575	95	80	X
H.P. Air Compressor	5511	7	24.351	58	80	X
MK 19 Gyro	4262	8	1.991	57	90	X
AN/SQS-26CX Sonar	4631	9	11.882	133	70	X
EM. Diesel Gen. Sets	3111	9	2.190	95	80	X
AN/SRC-21 (Radio)	4414	11	1.881	67	80	X
Air Conditioning Unit	5142	12	1.938	43	90	X
Fire & Flushing Pumps	5211	13	6.003	149	60	X
AN/SRC-20 (Radio)	4414	14	1.219	51	90	X
AN/ULQ-6C (E.C.M.)	4711	15	2.405	172	60	X
AN/URT-23(V) Radio	4412	16	1.367	31	90	X
MK NC-2 Plotting Table	4264	16	1.186	47	90	X
AN/SPA-50A (Radar Range Ind.)	4111	16	1.065	82	80	X
Personnel Boat	5831	19	2.269	23	90	X
AN/SLA-15 Antenna	4711	20	.752	51	100	X
AN/URA-38 (Radio)	4411	21	.833	45	90	X
AN/SPS-40 (Radar)	4521	22	7.279	271	40	X
AN/SPS-10F (Radar)	4511	23	1.827	67	60	X
MK 53 Mod 0 Attack Console (MK 114 FCS)	4831	24	3.021	32	65	X
Gun 5"/54	7111	24	.419	222	90	X
AN/SPG-53 (GFCS Radar)	4811	26	5.723	160	40	X
AN/WLA-3A (Amplifier)	4721	27	1.259	20	80	X
Mn. Feed Booster Pump	2552	28	2.593	75	50	X
AN/UQN-4 (Sonar Xducer)	4241	29	.662	20	100	X
L.P. Air Compressor	5515	30	1.287	23	70	X
AN/SQS-26 Power Supply (LAPS)	4631	31	.904	35	75	X
AN/WRT-1A (Radio)	4412	32	1.019	30	70	X
AN/SPA-4 (Radar Range Ind.)	4111	33	1.240	17	70	X
Automatic Combustion Control	2212	34	.760	9	90	X
L.P. & H.P. Turbines	2311	35	1.854	46	40	X
AN/SPA-66 (Radar Ind.)	4111	35	1.052	55	50	X
RPNMSMS	7212	37	11.580	81	0	X
MK 16 MOD 2 Stable Element	4811	38	.777	57	50	X
Prairie Masker Comp.	5517	39	1.312	39	40	X
Dead Reckoning Analyzer (DRA)	4263	40	1.488	67	25	X
MK 68 Mod 3 Gun Director	4811	41	1.230	24	50	X
SSTG Gove	41				70	X

Example of Class-Level Critical Equipment List

TECHNIQUE DESCRIPTION SHEET

1. Item No.	2. Title			
40	Ship Class Baseline Repair Profile Development			
3. Description				
<p>This technique comprises the review of prior ROH history (i.e., SARP), analysis of data, and development of a summary listing of common repair items for a ship class. The objective of the listing is to identify recurrent repair items, and provide certain vital planning data (e.g., cost and manpower requirements) relative to these items. The procedure has been applied to the DDG-2 (see ref. 1) and other destroyer classes. The attached figure illustrates the format of the baseline repair profile.</p>				
DESIGN	4. Type of Technique	5. Cost Parameters	6. Effectiveness Parameters	7. Status
	Math Model	Life Cycle	Effectiveness	Concept
	Computer Program	Development	Perf. Capability	Technique Developed, Not Applied
	Engineering Procedure X	Procurement	Availability	
	Management Procedure	Installation	Reliability	Technique Applied One Time
	_____	Maintenance	Maintainability	Technique Applied Recurrently
	_____	Operation	None	X
	_____	Mgt/Tech Service		
	_____	Modification		
	_____	None		
APPLICATION	8. Type of System/Equipment	9. Life Cycle Phase	10. Functional Areas Supported	
	Total Ship X	Concept Form.	ROH Planning	
	Hull Structure	Validation	ROH Work Package Development	
	Propulsion	Development		
	Electric Plant	Acquisition P		
	Command & Surv.	Operation X		
	Auxiliaries	_____		
	Outfit/Furnish.	_____		
	Armament	_____		
	Destroyers X	_____		
11. References (ARINC Research Corporation publications unless otherwise indicated)				
<p>1. Develop Baseline Ship Repair Profile for DDG-2 Class Ships, Sept. 1975. (No publication number; request copies by title and reference to work order 1227-01.)</p>				

Continued

TECHNIQUE DESCRIPTION SHEET

1. Item No. 40 (Cont)	2. Title Ship Class Baseline Repair Profile Development (Cont)					
DDG-2 CLASS RECOMMENDED ROUTINE REPAIR ITEM						
SWBS Group <u>500</u>						
Title <u>Auxiliary Systems</u>						
Proposed SWLIN	Recommended Routine Repair Item Description	Quantity on Ship	MD (est. avg.)	Matl \$ (est. avg.)	Assign	Justification for Recommendation
531A03A	Repair both distiller brine overboard pumps	2	40	950	SY	7 of 8 SARPs reviewed
531A04A	Repair both distiller salt water heater drain pumps	2	25	700	SY	5 of 8 SARPs reviewed
531A05A	Class "B" overhaul both distiller distillate pumps	2	40	400	SY	6 of 8 SARPs reviewed
533A01A	Repair both portable water pumps and associated priming pumps	2 each	60	1,150	SY	5 of 8 SARPs reviewed
534A01A	Repair H.P. drain system including, but not limited to: (a) Class "B" overhaul relief and stop valves (b) Repair or replace piping	--	100	550	SY	5 of 8 SARPs reviewed
534A02A	Repair L.P. drain system including but not limited to: (a) Class "B" overhaul relief and stop valves (b) Repair or replace piping	--	260	3,400	SY	6 of 8 SARPs reviewed

Format of Baseline Repair Profile

TECHNIQUE DESCRIPTION SHEET

1. Item No.	2. Title				
41	Preparation of Technical Repair Standards				
3. Description					
<p>This technique consists of engineering analysis and preparation of standards for repairing specific equipments, as identified by APL/CID No. A long range Navy objective is to develop TRSs for all maintenance-significant items.</p>					
DESIGN	4. Type of Technique		5. Cost Parameters	6. Effectiveness Parameters	7. Status
	Math Model	—	Life Cycle	Effectiveness	Concept
	Computer Program	—	Development	Perf. Capability	Technique Developed, Not Applied
	Engineering Procedure	X	Procurement	Availability	
	Management Procedure	—	Installation	Reliability	Technique Applied One Time
		—	Maintenance	Maintainability	Technique Applied Recurrently
		—	Operation	None	X
		—	Mgt/Tech Service		
		—	Modification		
		—	None	X	
APPLICATION	8. Type of System/Equipment		9. Life Cycle Phase		10. Functional Areas Supported
	Total Ship	—	Concept Form.	—	ROH Planning Maintenance Engineering Analysis
	Hull Structure	—	Validation	—	
	Propulsion	X	Development	—	
	Electric Plant	X	Acquisition	—	
	Command & Surv.	P	Operation	X	
	Auxiliaries	X			
	Outfit/Furnish.	P			
Armament	P				
11. References (ARINC Research Corporation publications unless otherwise indicated)					
<p>Approximately 100 Technical Repair Standards for a variety of systems/equipments have been prepared by ARINC Research.</p>					

TECHNIQUE DESCRIPTION SHEET

1. Item No.	2. Title			
42	Management Plan for Use in LOE Preparation			
3. Description				
<p>A management plan and milestones for use by ship's force in preparation for Light-Off Examination (LOE) was developed and applied in several destroyer-type ships, including DD, DDG, DLG, and DE. The plan outlines and describes a plan of action which includes the significant administrative, training, and material maintenance tasks essential to LOE preparation. The plan, while designed for application to destroyers having 1200-psi propulsion plants, is adaptable to other types of ships.</p>				
DESIGN	4. Type of Technique	5. Cost Parameters	6. Effectiveness Parameters	7. Status
	Math Model	Life Cycle	Effectiveness	Concept
	Computer Program	Development	Perf. Capability	Technique Developed, Not Applied
	Engineering Procedure	Procurement	Availability	Technique Applied One Time
	Management Procedure X	Installation	Reliability	Technique Applied Recurrently X
		Maintenance	Maintainability	
		Operation	None	
		Mgt/Tech Service		
		Modification		
APPLICATION	8. Type of System/Equipment	9. Life Cycle Phase	10. Functional Areas Supported	
	Total Ship	Concept Form.	Light-Off Examination ROH Planning	
	Hull Structure	Validation		
	Propulsion X	Development		
	Electric Plant X	Acquisition		
	Command & Surv.	Operation X		
	Auxiliaries X			
	Outfit/Furnish.			
Armament				
11. References (ARINC Research Corporation publications unless otherwise indicated)				
1. Development of a Plan to Assist Ships in Preparing for the Propulsion Examination Board (PEB) Light-Off Examination (LOE), Pub. 1026-01-1-1291, Feb. 1974 2. DE-Type Management Plan and Program Outlines for Use in PEB/LOE Preparation, Pub. 1029-01-1-1311, July 1974 3. DD-Type Management Plan and Program Outlines for Use in PEB/LOE Preparation, 1230-01-1-1349, Jan. 1975 4. DDG-Type Management Plan and Program Outlines for Use in PEB/LOE Preparation, 1230-01-2-1350, Jan. 1975 5. DLG-Type Management Plan and Program Outlines for Use in PEB/LOE Preparation, Pub. 1230-01-2-1351, Jan. 1975				

AD-A051 704

ARINC RESEARCH CORP ANNAPOLIS MD
CATALOG OF TECHNIQUES SUPPORTING SHIP MAINTENANCE MANAGEMENT, (U)

F/G 13/10

JUN 76 N J SCARLETT

626-32-4-1502

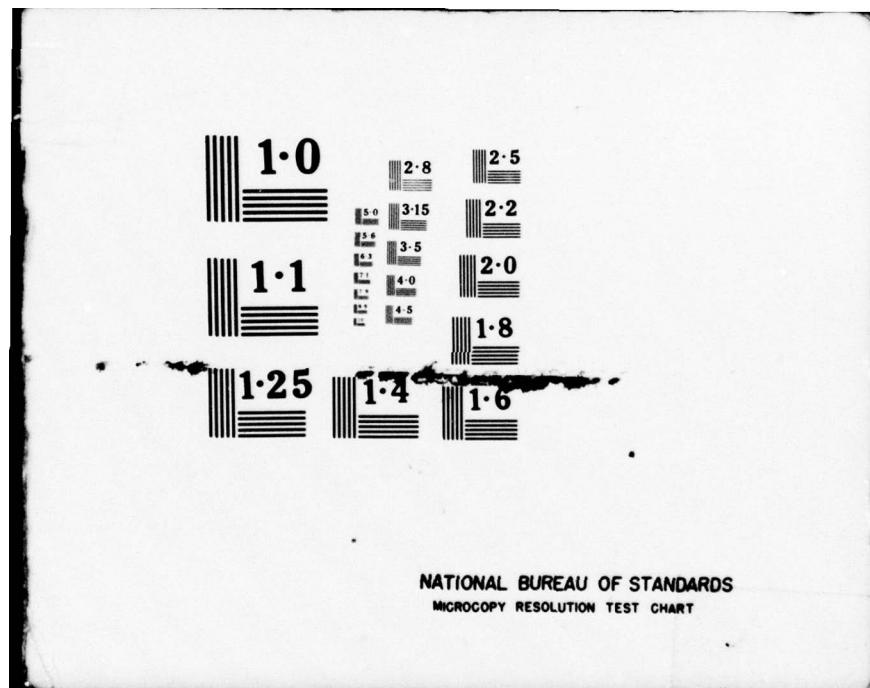
UNCLASSIFIED

2 OF 2
ADA
051704

NL



END
DATE
FILED
4 -78
DDC



NATIONAL BUREAU OF STANDARDS
MICROCOPY RESOLUTION TEST CHART

TECHNIQUE DESCRIPTION SHEET

1. Item No.	2. Title			
43	PEB/LOE Preparation Program			
<p>3. Description</p> <p>A technique for providing assistance to ship's force in preparing for LOE has been developed and applied to a variety of destroyer ROH programs (see references). The program consists of the following:</p> <ul style="list-style-type: none"> a. Task 1: Assist SF in review of SARP for LOE items. b. Task 2: Assist SF in establishing specific milestones for accomplishment of Plan and Outlines c. Task 3: Review SFOMS data entry forms for LOE items, completeness, and correctness. d. Task 4: Instruct SF in implementation and utilization of SFOMS. e. Task 5: Instruct SF in data entry of SFOMS information. f. Task 6: Provide weekly SFOMS reports. g. Task 7: Provide assistance to SF in LOE preparation. h. Task 8: Monitor progress in meeting LOE preparation milestones. i. Task 9: Make revisions to the Plan and Outlines. j. Task 10: Establish baseline for evaluation of the assistance program. 				
DESIGN	4. Type of Technique	5. Cost Parameters	6. Effectiveness Parameters	7. Status
	Math Model	Life Cycle	Effectiveness	Concept
	Computer Program	Development	Perf. Capability	Technique Developed, Not Applied
	Engineering Procedure	Procurement	Availability	
	Management Procedure	Installation	Reliability	Technique Applied One Time
	Training X	Maintenance	Maintainability	
		Operation	None	Technique Applied Recurrently X
		Mgt/Tech Service		
		Modification		
		None	X	
APPLICATION	8. Type of System/Equipment	9. Life Cycle Phase	10. Functional Areas Supported	
	Total Ship	Concept Form.	Training	
	Hull Structure	Validation	Light-Off Examination	
	Propulsion	X		
	Electric Plant	Development		
	Command & Surv.	Acquisition		
	Auxiliaries	Operation	X	
	Outfit/Furnish.			
Armament				
<p>11. References (ARINC Research Corporation publications unless otherwise indicated)</p> <ol style="list-style-type: none"> 1. PEB/LOE Assistance Program for USS FRANCIS HAMMOND (DE-1067) and USS MARVIN SHIELDS (DE-1066), Pub. 1224-01-1-1416, June 1975 2. PEB/LOE Assistance Program for USS OUELLET (FF-1077) and USS SAMPLE (FF-1048), Pub. 1228-01-1-1426, July 1975 3. PEB/LOE Assistance Program for USS DECATUR (DDG-31) USS SOMERS (DDG-34), USS BUCHANAN (DDG-14), USS MORTON (DD-948) and USS RICHARD S. EDWARDS (DD-950); being prepared 				

TECHNIQUE DESCRIPTION SHEET

1. Item No.	2. Title			
44	Pre-Overhaul Training of Ship Personnel			
3. Description				
<p>A procedure for indoctrinating ship's force personnel during initial ROH planning has been developed and applied to destroyer ROH programs. The procedure consists of briefing ship's force personnel using a script, slides, and handout material. Separate packages were developed for naval and commercial shipyard situations. The procedure, while specific to destroyer ROH programs, can be adapted for other types of ship.</p>				
DESIGN	4. Type of Technique	5. Cost Parameters	6. Effectiveness Parameters	7. Status
	Math Model	Life Cycle	Effectiveness	Concept
	Computer Program	Development	Perf. Capability	Technique Developed, Not Applied
	Engineering Procedure	Procurement	Availability	
	Management Procedure	Installation	Reliability	Technique Applied One Time
	Training	Maintenance	Maintainability	
	Procedure	Operation	None	Technique Applied Recurrently
		Mgt/Tech Service		
		Modification	X	
	None			
APPLICATION	8. Type of System/Equipment	9. Life Cycle Phase	10. Functional Areas Supported	
	Total Ship	Concept Form.	Training ROH Planning	
	Hull Structure	Validation		
	Propulsion	Development		
	Electric Plant	Acquisition		
	Command & Surv.	Operation		
	Auxiliaries			
	Outfit/Furnish.			
	Armament			
Destroyers	X			
11. References (ARINC Research Corporation publications unless otherwise indicated)				
<p>1. Ship's Pre-Overhaul Briefing, Pub. 1226-01-1-1346, Jan. 1975</p>				

TECHNIQUE DESCRIPTION SHEET

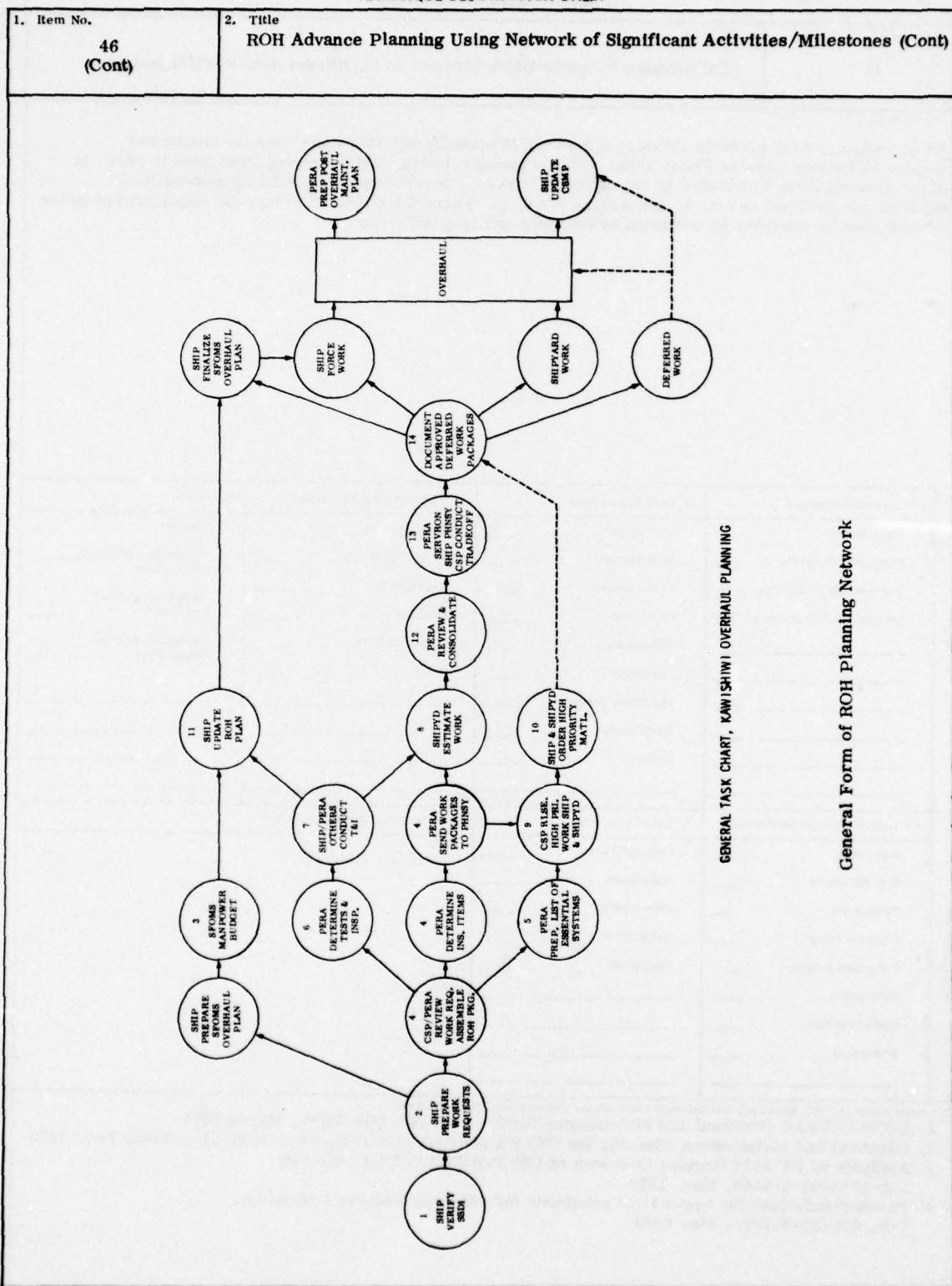
1. Item No.	2. Title				
45	Shipcheck Planning				
3. Description					
<p>Shipcheck planning encompasses a set of actions, listed in their order of recommended accomplishment, to be considered when planning a program of pre-overhaul material inspections/shipchecks.</p>					
DESIGN	4. Type of Technique		5. Cost Parameters	6. Effectiveness Parameters	7. Status
	Math Model	—	Life Cycle	Effectiveness	Concept <input checked="" type="checkbox"/>
	Computer Program	—	Development	Perf. Capability	Technique Developed, Not Applied <input type="checkbox"/>
	Engineering Procedure	—	Procurement	Availability	Technique Applied One Time <input type="checkbox"/>
	Management Procedure	X	Installation	Reliability	Technique Applied Recurrently <input type="checkbox"/>
		—	Maintenance	Maintainability	<input type="checkbox"/>
		—	Operation	None	X <input type="checkbox"/>
		—	Mgt/Tech Service	<input type="checkbox"/>	<input type="checkbox"/>
		—	Modification	<input type="checkbox"/>	<input type="checkbox"/>
APPLICATION	8. Type of System/Equipment		9. Life Cycle Phase	10. Functional Areas Supported	
	Total Ship	X	Concept Form.	Pre-Overhaul Test and Inspection ROH Planning	
	Hull Structure	—	Validation	<input type="checkbox"/>	
	Propulsion	—	Development	<input type="checkbox"/>	
	Electric Plant	—	Acquisition	<input type="checkbox"/>	
	Command & Surv.	—	Operation	X	<input type="checkbox"/>
	Auxiliaries	—	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
	Outfit/Furnish.	—	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Armament	—	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
11. References (ARINC Research Corporation publications unless otherwise indicated)					
1. Guide for Overhaul Planning Term Accomplishment of Pre-Overhaul Material Inspections, Shipchecks and Tests, Pub. W3-006-TN02, Jan. 1973					

TECHNIQUE DESCRIPTION SHEET

1. Item No.	2. Title			
46	ROH Advance Planning Using Network of Significant Activities/Milestones			
3. Description				
<p>An approach to ROH planning utilizing a network of planning activities has been developed and applied to various Service Force ships. The planning network, while varying from case to case, is of the general form illustrated by the attached figure. Specific applications of the generalized network can be found in ref. 4, appendixes A and B. These examples show how the illustrated planning network can be extended by inclusion of schedule and responsibility.</p>				
DESIGN	4. Type of Technique	5. Cost Parameters	6. Effectiveness Parameters	7. Status
	Math Model	Life Cycle	Effectiveness	Concept
	Computer Program	Development	Perf. Capability	Technique Developed, Not Applied
	Engineering Procedure	Procurement	Availability	
	Management Procedure X	Installation	Reliability	Technique Applied One Time
		Maintenance	Maintainability	Technique Applied Recurrently
		Operation	None X	X
		Mgt/Tech Service		
		Modification		
APPLICATION	8. Type of System/Equipment	9. Life Cycle Phase	10. Functional Areas Supported	
	Total Ship X	Concept Form.	ROH Planning	
	Hull Structure	Validation		
	Propulsion	Development		
	Electric Plant	Acquisition		
	Command & Surv.	Operation X		
	Auxiliaries			
	Outfit/Furnish.			
	Armament			
11. References (ARINC Research Corporation publications unless otherwise indicated) <ol style="list-style-type: none"> 1. COMSERVPAC Overhaul and Maintenance Guide, Pub. W3-D06-TN07, March 1973 2. Overhaul and Maintenance Planning for USS KAWISHIWI (AO-146), Pub. 1600-01-1-1269, Dec. 1973 3. Analysis of FY 1974 Regular Overhaul of USS PONCHATOUA (AO-148), Pub 1605-01-1-1340, Nov. 1974 4. Recommendations for Improved Techniques for Planning Regular Overhauls, Pub. 626-32-3-1395, May 1975 				

Continued

TECHNIQUE DESCRIPTION SHEET



TECHNIQUE DESCRIPTION SHEET

1. Item No.	2. Title				
47	Pre-Overhaul Test and Inspection Procedure				
3. Description					
<p>This technique is a three-phased procedure for conducting Pre-Overhaul Test and Inspection (POT&I) of shipboard systems/equipments. The procedure is described in the attached sheet, and applicable forms are illustrated in the attached figures. The POT&I procedure is illustrated in ref. 1 relative to the fire and tank cleaning system for AO-143 class ships.</p>					
DESIGN	4. Type of Technique		5. Cost Parameters	6. Effectiveness Parameters	7. Status
	Math Model	_____	Life Cycle	Effectiveness	Concept
	Computer Program	_____	Development	Perf. Capability	Technique Developed, <input checked="" type="checkbox"/> Not Applied
	Engineering Procedure	<input checked="" type="checkbox"/>	Procurement	Availability	Technique Applied
	Management Procedure	_____	Installation	Reliability	One Time
		_____	Maintenance	Maintainability	Technique Applied Recurrently
		_____	Operation	None	_____
		_____	Mgt/Tech Service	Material	_____
		_____	Modification	Condition	<input checked="" type="checkbox"/>
APPLICATION	8. Type of System/Equipment		9. Life Cycle Phase	10. Functional Areas Supported	
	Total Ship	_____	Concept Form.	Pre-Overhaul Test and Inspection (POT&I) Material Condition Assessment ROH Work Package Development	
	Hull Structure	P	Validation		
	Propulsion	P	Development		
	Electric Plant	P	Acquisition		
	Command & Surv.	P	Operation		
	Auxiliaries	X	_____		
	Outfit/Furnish.	P	_____		
Armament	P	_____			
11. References (ARINC Research Corporation publications unless otherwise indicated)					
1. A Procedure for Determining Overhaul Work Requirements for Fire and Tank Cleaning System in Fire Room of AO-143 Class Ships, Pub. W3-006-TN01, Jan. 1973					

Continued

TECHNIQUE DESCRIPTION SHEET

1. Item No.	2. Title
47 (Cont)	Pre-Overhaul Test and Inspection Procedure (Cont)
PHASE I: CRITIQUE	
<p>The first phase of POT&I is a critique of the subsystem of interest with cognizant ship's force personnel. The critique will normally be performed by overhaul planning personnel from the overhaul activity or PERA responsible for putting together the overhaul repair package. The objective is to determine the general status of the subsystem and its interfaces, thus permitting the emphasis in more detailed inspections to be placed upon those areas suspected of requiring overhaul or extensive repair.</p>	
<p>The critique will include 1) discussions of the condition of the subsystem with respect to past performance, operating hours, corrective and preventive maintenance performed, and isolated and recurring problems/malfunctions or failures; and 2) an attempt to establish if gradual deterioration has been taking place. Information obtained during these discussions is to be recorded on the Phase 1 data sheet (see Figure 1).</p>	
PHASE II: VISUAL INSPECTION	
<p>A systematic visual inspection will be performed, utilizing the Pre-Overhaul Test and Inspection Evaluation Form (see Figure 2) specifically tailored to the subsystem under investigation. This inspection will normally be performed by shipboard personnel as part of the overhaul planning process. If properly performed, the visual inspection will provide the status information needed for realistic evaluations of the need for partial or complete overhauls, and for estimating the cost of parts and man-hours required to perform the overhaul.</p>	
PHASE III: OPERATIONAL AND/OR SPECIALIZED TESTS	
<p>If the visual inspection conducted during Phase II indicates marginal or doubtful conditions as far as determining overhaul work requirements is concerned, operational or specialized tests will be conducted. These tests (Phase III) may require additional detailed test procedures, but will usually consist of observing normal operations and recording conditions.</p>	
<p>The purposes of the Phase III tests are to 1) demonstrate the operating condition of the machinery and the nature of its defects, and 2) afford a means of judging the full extent of repairs or alterations necessary to improve efficiency, or to restore the system to a condition fit for further service. During these tests, those areas defined as marginal in the detailed visual inspection of Phase II will be reevaluated.</p>	
<p>Where indicated, Phase III tests designed for each specific subsystem will be performed. The detailed inspection and testing for Phase III will consist of the performance of those major preventive maintenance actions that will either restore the equipment to satisfactory performance or indicate that complete overhaul or replacement is required. Results of the Phase III trials and tests will be incorporated in the applicable Remarks column of the Phase II POT&I Evaluation Form (Figure 2).</p>	

Continued

TECHNIQUE DESCRIPTION SHEET

1. Item No. 47 (Cont)	2. Title Pre-Overhaul Test and Inspection Procedure (Cont)
<p style="text-align: center;">AO-143 CLASS PRE-OVERHAUL SHIP CHECK, INSPECTIONS AND TESTS PHASE I DATA SHEET CRITIQUE</p> <p>SHIP: _____</p> <p>SYSTEM: _____</p> <p>NOTES AND REMARKS: _____</p>	
<p>(Use additional sheets if required)</p> <p>Observer _____ Page _____ DATE _____ of _____</p>	

Figure 1. Example of POT&I Phase I Data Sheet

Continued

TECHNIQUE DESCRIPTION SHEET

1. Item No. 47 (Cont)		2. Title Pre-Overhaul Test and Inspection Procedure (Cont)																																													
<table border="1"> <tr> <td colspan="2">Ship: KAWISHIWI AO-146</td> <td>Date: _____</td> <td colspan="5">System/Equipment: Fire and Flushing Pump</td> </tr> <tr> <td colspan="2">Applicable Documents: AO 143-S4805-H123364-E, 635-D, 636-E, 637-E</td> <td>Observer: _____</td> <td colspan="5"></td> </tr> <tr> <th>Item No.</th> <th>Nomenclature or Service</th> <th>Ship's Part No.</th> <th>Material List Mark No.</th> <th>Location</th> <th>Inspection Criteria/Notes</th> <th>Inspected</th> <th>Results/Remarks</th> </tr> <tr> <td>10.0</td> <td>Fire and flushing pump</td> <td></td> <td></td> <td>Fireroom, hold, std.</td> <td>1. Casing: Check for leaks around the casing flange, loose or stripped casing studs, general preservation.</td> <td>Yes</td> <td>No</td> </tr> <tr> <td colspan="8"> <p>2. Suction Nozzle: Check for leaks around flange, loose or stripped flange studs/nuts, general preservation.</p> <p>3. Discharge Nozzle: Same as 2.</p> <p>4. Bedplate support brackets and foundation (ship frame): Check rigidity of pump mounting. Look for worn, loose, stripped or corroded mounting bolts and brackets. Check ship frame for weakness caused by rust and corrosion. Perform MR F-17 (A-1) during this check, i.e., sound and tighten foundation bolts. Record in Remarks the general condition of preservation.</p> </td> </tr> </table>								Ship: KAWISHIWI AO-146		Date: _____	System/Equipment: Fire and Flushing Pump					Applicable Documents: AO 143-S4805-H123364-E, 635-D, 636-E, 637-E		Observer: _____						Item No.	Nomenclature or Service	Ship's Part No.	Material List Mark No.	Location	Inspection Criteria/Notes	Inspected	Results/Remarks	10.0	Fire and flushing pump			Fireroom, hold, std.	1. Casing: Check for leaks around the casing flange, loose or stripped casing studs, general preservation.	Yes	No	<p>2. Suction Nozzle: Check for leaks around flange, loose or stripped flange studs/nuts, general preservation.</p> <p>3. Discharge Nozzle: Same as 2.</p> <p>4. Bedplate support brackets and foundation (ship frame): Check rigidity of pump mounting. Look for worn, loose, stripped or corroded mounting bolts and brackets. Check ship frame for weakness caused by rust and corrosion. Perform MR F-17 (A-1) during this check, i.e., sound and tighten foundation bolts. Record in Remarks the general condition of preservation.</p>							
Ship: KAWISHIWI AO-146		Date: _____	System/Equipment: Fire and Flushing Pump																																												
Applicable Documents: AO 143-S4805-H123364-E, 635-D, 636-E, 637-E		Observer: _____																																													
Item No.	Nomenclature or Service	Ship's Part No.	Material List Mark No.	Location	Inspection Criteria/Notes	Inspected	Results/Remarks																																								
10.0	Fire and flushing pump			Fireroom, hold, std.	1. Casing: Check for leaks around the casing flange, loose or stripped casing studs, general preservation.	Yes	No																																								
<p>2. Suction Nozzle: Check for leaks around flange, loose or stripped flange studs/nuts, general preservation.</p> <p>3. Discharge Nozzle: Same as 2.</p> <p>4. Bedplate support brackets and foundation (ship frame): Check rigidity of pump mounting. Look for worn, loose, stripped or corroded mounting bolts and brackets. Check ship frame for weakness caused by rust and corrosion. Perform MR F-17 (A-1) during this check, i.e., sound and tighten foundation bolts. Record in Remarks the general condition of preservation.</p>																																															

Figure 2. Example of POT&I Evaluation Form

TECHNIQUE DESCRIPTION SHEET

1. Item No.	2. Title				
48	Development of Standardized Work Requests for ATF/ARS Ships				
3. Description					
<p>A set of standardized work requests applicable to high recurrency jobs normally accomplished during regular overhaul of ATF/ARS ships was developed based on prior history. The objectives of the set is to increase the accuracy of certain key data items essential for ROH planning, and reduce the administrative burden of ship's force during ROH planning. The set consists of 225 items covering yard, tender, and ship's force work. The attached figure is a sample of the standardized work request. The package has been applied in ROH planning for an ATF class ship. While the package itself is limited in applicability to this one type of ship, the approach is considered applicable to ROH planning for any type of ship having a reasonable population.</p>					
DESIGN	4. Type of Technique		5. Cost Parameters	6. Effectiveness Parameters	7. Status
	Math Model	—	Life Cycle	Effectiveness	Concept
	Computer Program	—	Development	Perf. Capability	Technique Developed, Not Applied
	Engineering Procedure	X	Procurement	Availability	Technique Applied One Time
	Management Procedure	—	Installation	Reliability	X
		—	Maintenance	Maintainability	Technique Applied Recurrently
		—	Operation	None	—
		—	Mgt/Tech Service	—	—
		—	Modification	—	—
		—	None	X	—
APPLICATION	8. Type of System/Equipment		9. Life Cycle Phase	10. Functional Areas Supported	
	Total Ship (ATF / ARS)	X	Concept Form.	ROH Planning ROH Work Packages Development	
	Hull Structure	—	Validation		
	Propulsion	—	Development		
	Electric Plant	—	Acquisition		
	Command & Surv.	—	Operation	X	
	Auxiliaries	—	—	—	—
	Outfit/Furnish.	—	—	—	—
	Armament	—	—	—	—
11. References (ARINC Research Corporation publications unless otherwise indicated)					
<ol style="list-style-type: none"> 1. ATF/ARS ROH Planning Study, informational briefing (copies available from Ships & Ordnance Division) 2. Regular Overhaul Work Book for ATF/ARS Type Ships, Oct. 1974, informal publication; copies available from Ships & Ordnance Division 					

Continued

TECHNIQUE DESCRIPTION SHEET

1. Item No. 48 (Cont)	2. Title Development of Standardized Work Requests for ATF/ARS Ships (Cont)																																													
MAINTENANCE DATA FORM																																														
		MAINTENANCE ACTION <input type="checkbox"/> COMPL <input type="checkbox"/> DEFER <input checked="" type="checkbox"/> MAX																																												
SHIP NAME HULL NUMBER JOB CONTROL NUMBER EM 02		SECTION I T 10 C																																												
		AS DISCOVERED INFORMATION 13. DATE 14. DUPLICATE DAY MONTH YEAR DAY STATUS 15. ACTUALIZATION TIME ALT. ORIGINALLY PLANNED																																												
SECTION II - COMPLETED ACTION <table border="1" style="width: 100%; border-collapse: collapse;"> <tr> <td style="width: 10%;">11. ACT.</td> <td style="width: 10%;">12. MAN HOURS</td> <td style="width: 10%;">13. RATING RATE</td> <td style="width: 10%;">14. MILEAGE RATE</td> <td style="width: 10%;">15. ACT. DATE</td> <td style="width: 10%;">16. ACT. MILE. TIME</td> <td style="width: 10%;">17. ACT. VOL.</td> <td style="width: 10%;">18. EQUIP. METER READING</td> <td style="width: 10%;">19. MILES</td> </tr> <tr> <td> </td> </tr> <tr> <td> </td> </tr> </table>			11. ACT.	12. MAN HOURS	13. RATING RATE	14. MILEAGE RATE	15. ACT. DATE	16. ACT. MILE. TIME	17. ACT. VOL.	18. EQUIP. METER READING	19. MILES																																			
11. ACT.	12. MAN HOURS	13. RATING RATE	14. MILEAGE RATE	15. ACT. DATE	16. ACT. MILE. TIME	17. ACT. VOL.	18. EQUIP. METER READING	19. MILES																																						
SECTION III - DEFERRAL ACTION PLANNING <table border="1" style="width: 100%; border-collapse: collapse;"> <tr> <td style="width: 10%;">11. ACT.</td> <td style="width: 10%;">12. MAN HOURS</td> <td style="width: 10%;">13. RATING RATE</td> <td style="width: 10%;">14. MILEAGE RATE</td> <td style="width: 10%;">15. DEFERRED DATE</td> <td style="width: 10%;">16. INSTALLED AND REPAIR TYPE</td> <td style="width: 10%;">17. COUNTER</td> <td style="width: 10%;">18. ACT. MILE. TIME</td> <td style="width: 10%;">19. ACT. VOL.</td> <td style="width: 10%;">20. EQUIP. METER READING</td> <td style="width: 10%;">21. MILES</td> </tr> <tr> <td> </td> </tr> <tr> <td> </td> </tr> <tr> <td> </td> </tr> </table>			11. ACT.	12. MAN HOURS	13. RATING RATE	14. MILEAGE RATE	15. DEFERRED DATE	16. INSTALLED AND REPAIR TYPE	17. COUNTER	18. ACT. MILE. TIME	19. ACT. VOL.	20. EQUIP. METER READING	21. MILES																																	
11. ACT.	12. MAN HOURS	13. RATING RATE	14. MILEAGE RATE	15. DEFERRED DATE	16. INSTALLED AND REPAIR TYPE	17. COUNTER	18. ACT. MILE. TIME	19. ACT. VOL.	20. EQUIP. METER READING	21. MILES																																				
SECTION IV - REMARKS/DESCRIPTION REPAIR CONDITIONS COOLER FOLLOWING CONDITIONS REQUIRE MAINTENANCE ACTION XXXX DISASSEMBLE CLEAN CONDUCT HYDROSTATIC TEST AND AND REPAIR / REPLACE DEFECTIVE TUBES / PART S. AND PRESERVE X SHIPS FORCE INSTALL AND TEST																																														
1ST CONTACT MAINT. MAN A 2ND CONTACT SUPERVISOR NAME B CO SIGNATURE C																																														
SECTION V - FAILED PARTS/COMPONENT <table border="1" style="width: 100%; border-collapse: collapse;"> <tr> <td style="width: 25%;">10. ITEM TO LIA</td> <td style="width: 25%;">11. MFG. PART NO.</td> <td style="width: 25%;">12. MFG. CODE</td> <td style="width: 25%;">13. SERIAL NUMBER</td> <td style="width: 25%;">14. FPI CODE</td> <td style="width: 25%;">15. DEF. SYMBOL</td> <td style="width: 25%;">16. MILES</td> </tr> <tr> <td> </td> </tr> <tr> <td> </td> </tr> <tr> <td> </td> </tr> </table>			10. ITEM TO LIA	11. MFG. PART NO.	12. MFG. CODE	13. SERIAL NUMBER	14. FPI CODE	15. DEF. SYMBOL	16. MILES																																					
10. ITEM TO LIA	11. MFG. PART NO.	12. MFG. CODE	13. SERIAL NUMBER	14. FPI CODE	15. DEF. SYMBOL	16. MILES																																								
SECTION VI - SUPPLEMENTARY INFORMATION <table border="1" style="width: 100%; border-collapse: collapse;"> <tr> <td style="width: 50%;">17. BLUEPRINTS, TECH. MANUALS, P. ANS. ETC.</td> <td style="width: 50%;">18. AVAILABLE ON BOARD YES NO</td> <td colspan="2">19. PREARRIVAL AND OR ARRIVAL CONFERENCE ACTION - REMARKS</td> </tr> <tr> <td> </td> <td> </td> <td colspan="2"> </td> </tr> <tr> <td> </td> <td> </td> <td colspan="2"> </td> </tr> <tr> <td> </td> <td> </td> <td colspan="2"> </td> </tr> </table>			17. BLUEPRINTS, TECH. MANUALS, P. ANS. ETC.	18. AVAILABLE ON BOARD YES NO	19. PREARRIVAL AND OR ARRIVAL CONFERENCE ACTION - REMARKS																																									
17. BLUEPRINTS, TECH. MANUALS, P. ANS. ETC.	18. AVAILABLE ON BOARD YES NO	19. PREARRIVAL AND OR ARRIVAL CONFERENCE ACTION - REMARKS																																												
20. LEAD P.R.C. CODE 21. PLANNER ID 22. DATE OF ESTIMATE - ARRIVAL - DAYS TOTAL VENDORS IN DOLLARS MATERIAL TOTAL COST 23. DOCT. # 24. DOCT. # 25. DOCT. # 26. DOCT. # 27. DOCT. # 28. DOCT. # 29. DOCT. # 30. DOCT. #																																														
31. CUMULATIVE REPAIR HISTORY 32. CUMULATIVE DOCT. 33. ALLEGED BY																																														

Sample of Standardized Work Request

TECHNIQUE DESCRIPTION SHEET

1. Item No.	2. Title			
49	Scoping and Estimating Ship's Force Regular Overhaul Work			
3. Description				
<p>A procedure and a set of guidelines was developed as an aid to ship's force for (1) identifying key operations associated with recurring ship's force jobs, (2) estimating the manpower required to accomplish each key operation, and (3) scheduling key operations. The guidelines, consolidated into manual format, are specifically intended to support preparation of Ship's Force Overhaul Management System (SFOMS) input data for destroyer-type ships. However, the approach, and to a extent the guidelines, can apply to other types of ship. The attached figure illustrates the format and content of the guidelines.</p>				
DESIGN	4. Type of Technique	5. Cost Parameters	6. Effectiveness Parameters	7. Status
	Math Model	Life Cycle	Effectiveness	Concept
	Computer Program	Development	Perf. Capability	Technique Developed, Not Applied <input checked="" type="checkbox"/>
	Engineering Procedure <input checked="" type="checkbox"/>	Procurement	Availability	Technique Applied One Time
	Management Procedure	Installation	Reliability	Technique Applied Recurrently
		Maintenance	<input checked="" type="checkbox"/>	
		Operation	None	
		Mgt/Tech Service		
		Modification		
		None		
APPLICATION	8. Type of System/Equipment	9. Life Cycle Phase	10. Functional Areas Supported	
	Total Ship	Concept Form.	ROH Planning	
	Hull Structure <input checked="" type="checkbox"/>	Validation	SFOMS Planning	
	Propulsion <input checked="" type="checkbox"/>	Development		
	Electric Plant <input checked="" type="checkbox"/>	Acquisition		
	Command & Surv. <input checked="" type="checkbox"/>	Operation <input checked="" type="checkbox"/>		
	Auxiliaries <input checked="" type="checkbox"/>			
	Outfit/Furnish. <input checked="" type="checkbox"/>			
Armament <input checked="" type="checkbox"/>				
11. References (ARINC Research Corporation publications unless otherwise indicated)				

Continued

TECHNIQUE DESCRIPTION SHEET

Format and Typical Content of SFOMS Planning Guidelines

TECHNIQUE DESCRIPTION SHEET

1. Item No.	2. Title			
50	Estimating Nonindustrial Labor Requirements for Ship's Force During ROH			
3. Description				
<p>A procedure and associated guidelines for estimating nonindustrial (i.e., leave, administrative tasks, military duties, etc.) labor requirements for ship's force during ROH was developed for destroyer-type ships. The estimating factors were derived from review and analysis of prior ROH history. The purpose of the procedure is to assist ship's force in estimating the quantity of manpower that will be available during ROH for performance of maintenance. The attached figure 1 is a sample of the guidelines. A unique set of estimating factors was established for each type of work center and each type of ship. Figure 2 describes the procedure and shows the format to be used in making the estimates.</p>				
DESIGN	4. Type of Technique	5. Cost Parameters	6. Effectiveness Parameters	7. Status
	Math Model	Life Cycle	Effectiveness	Concept
	Computer Program	Development	Perf. Capability	Technique Developed, <input checked="" type="checkbox"/>
	Engineering Procedure <input checked="" type="checkbox"/>	Procurement	Availability	Not Applied
	Management Procedure	Installation	Reliability	Technique Applied One Time
		Maintenance	Maintainability	Technique Applied Recurrently
		Operation	None <input checked="" type="checkbox"/>	
		Mgt/Tech Service		
		Modification		
		None		
APPLICATION	8. Type of System/Equipment	9. Life Cycle Phase	10. Functional Areas Supported	
	Ship <input checked="" type="checkbox"/>	Concept Form.	ROH Planning SFOMS Planning	
	Hull Structure	Validation		
	Propulsion	Development		
	Electric Plant	Acquisition		
	Command & Surv.	Operation <input checked="" type="checkbox"/>		
	Auxiliaries			
	Outfit/Furnish.			
	Armament			
11. References (ARINC Research Corporation publications unless otherwise indicated)				
1. Guidelines for Estimating Ship's Force Non-Industrial Manpower Requirements During ROH, Pub. TN W5-1231-TN03, Aug. 1975.				

Continued

TECHNIQUE DESCRIPTION SHEET

1. Item No.	2. Title
50 (Cont)	Estimating Nonindustrial Labor Requirements for Ship's Force During ROH (Cont)

The procedure for estimating nonindustrial labor requirements for ship's force during regular overhaul comprises the six steps described below. The circled numbers (e.g., ①) in Figure 2 identify the specific blocks of information associated with each step.

- a. Step 1 - Fill in ship name and hull number, work center, and date.
- b. Step 2 - Identify each week (e.g., February 1, February 8, etc.), starting with the first and ending with the last week of the ROH.
- c. Step 3 - Compute and record in line 27 the number of man-hours assigned for each week of the ROH. This is determined by multiplying the number of men assigned to the work center by the number of normal working hours in that week (i.e., exclusive of holidays). For example, if there are 10 men assigned to a work center, four work days in the week, and seven work hours per day, the number of man-hours available is 280. Appendix G of the manual identifies the normal number of workdays for each calendar week through 1980.
- d. Step 4 - Estimate the number of man-hours required for each nonindustrial function. This quantity is based on the percentage of total manpower expected to be assigned for each function during each week. The guidelines contained in Appendixes A through E of the manual provide assistance in formulating these estimates.
- e. Step 5 - Add the man-hours computed for lines 1 through 25, and enter the total non-industrial manpower requirements in line 26.
- f. Step 6 - Subtract line 26 from line 27 to determine the number of productive man-hours available during each week of the ROH.

Continued

TECHNIQUE DESCRIPTION SHEET

1. Item No. 50 (Cont)	2. Title Estimating Nonindustrial Labor Requirements for Ship's Force During ROH (Cont)		
SFOMS ESTIMATING GUIDELINES FOR NONINDUSTRIAL FUNCTIONS			
Type(s) of Ship <u>DDG</u>	Work Center(s) <u>FIREROOM</u> <u>(EB01, EB02)</u>		
Function	Percentage (%) of Assigned Manpower		
	Average	Lower	Upper
1. Leave	7	4	10.5
2. Military Watches	3.5	2	8
3. Fire Watches	3.5	0	8.5
4. Training (On-board)	6	1.5	14
5. Compartment Cleaning	4.5	1	10
6. Food Preparation	-	-	-
7. Administration	5	0	14.5
8. Supply Office/Storerooms	-	-	-
9. SOAP Team	3.5	0	8.5
10. Supervision	5	4	10
11. Personal Services	5	0.5	8.5
12. Working Parties	1	0	2
13. PMS/PMDO	4.5	0	15
14. School (Off-ship)	4.5	2.5	10.5
15. Cleanup (General)	-	-	-
16. Sick Bay (Hospitalmen)	-	-	-
17. Trouble Calls	1	0	2.5
18. Special Liberty	6	0	6.5
19. Mess Cooks	3	0	5
20. Offices (Ships/Post/Disbursing)	-	-	-
21. Laundry/Ships Store/Barber Shop*	-	-	-
22. Duty Driver	1	0	2
23. Shore Patrol/Brig	1	0	2
24.			
25.			
TOTAL	65		
Remarks:			
*Ships Servicemen functions.			

Figure 1. Sample of Guidelines for Estimating Nonindustrial Labor Requirements

Continued

TECHNIQUE DESCRIPTION SHEET

1. Item No.	2. Title
50 (Cont)	Estimating Nonindustrial Labor Requirements for Ship's Force During ROH (Cont)
Procedure for Estimating Nonindustrial Labor Requirements	
Function	Manpower (Manhours) Required
1. Leave	
2. Military Watches	
3. Fire Watches	
4. Training (On-board)	
5. Compartment Cleaning	
6. Food Preparation	
7. Administration	
8. Supply Office/Storerooms	
9. SOAP Team	
10. Supervision	
11. Personal Services	
12. Working Parties	
13. PMS/PMDO	
14. School (Off-ship)	
15. Cleanup (General)	
16. Sick Bay (Hospitalmen)	
17. Trouble Calls	
18. Special Liberty	
19. Mess Cooks	
20. Offices (Ships/Post/Disbursing)	
21. Laundry/Ships Store/Barber Shop*	
22. Duty Driver	
23. Shore Patrol/Brig	
24.	
25.	
26. Total Nonindustrial (add lines 1-25)	(5)
27. Total Manpower Assigned (Manhour)	(3)
28. Productive Manhours Available (Subtract line 26 from line 27)	(6)

*Ships Servicemen functions.

Figure 2. Procedure for Estimating Nonindustrial Labor Requirements (See Discussion)

TECHNIQUE DESCRIPTION SHEET

1. Item No.	2. Title			
51	Effectiveness Analysis of Ship Regular Overhaul			
3. Description				
<p>This technique involves tracking scheduled and actual accomplishment of regular overhaul to determine and assess effectiveness of the ROH in terms of schedule adherence, assessment of material condition problems encountered, and various other significant effectiveness parameters. Principal data sources used include the ROH work package generated by ship's force, departure reports, and other related documentation. The technique has been applied to a variety of AO, ATF, AE, AOG and ARS types of ships (see references), and resulted in sets of recommendations for application in subsequent ROHs.</p>				
DESIGN	4. Type of Technique		5. Cost Parameters	
	Math Model	—	Life Cycle	—
	Computer Program	—	Development	—
	Engineering Procedure	X	Procurement	—
	Management Procedure	X	Installation	—
		—	Maintenance	—
		—	Operation	—
		—	Mgt/Tech Service	—
		—	Modification	—
APPLICATION	8. Type of System/Equipment		9. Life Cycle Phase	10. Functional Areas Supported
	Total Ship	X	Concept Form.	ROH Planning
	Hull Structure	X	Validation	ROH Effectiveness Analysis
	Propulsion	X	Development	
	Electric Plant	X	Acquisition	
	Command & Surv.	X	Operation	X
	Auxiliaries	X		
	Outfit/Furnish.	X		
	Armament	X		
11. References (ARINC Research Corporation publications unless otherwise indicated)				
1. Study of USS MISPILLION (AO-105) 1970 Regular Overhaul, Pub. 693-01-1-1075, Sept. 1970 2. Study of USS VESUVIUS (AE-15) 1970 Regular Overhaul, Pub. 696-01-1-1092, Dec. 1970 3. Study of USS COCOPA (ATF-101) 1970-71 Regular Overhaul, Pub. D02-01-1-1109, April 1971 4. Study of USS CALIENTE (AO-53) 1971 Regular Overhaul, Vol. V, Pub. D03-01-1-1115, June 1971 5. Study of USS GENESEE (AOG-8) Regular Overhaul, Pub. D05-01-1-1122, July 1971 6. Overhaul and Maintenance Planning for USS KAWISHIWI (AO-106), Pub. 1600-01-1-1269, Dec. 1973 7. Analysis of FY 1974 Regular Overhaul of USS SAFEGUARD (ARS-25), Pub. 1609-01-1-1308, July 1974 8. USS MOLALA (ATF-106) Post Overhaul Analysis Report, Pub. 1020-01-1-1303C, Oct. 1974				

Continued

TECHNIQUE DESCRIPTION SHEET

1. Item No. 51 (Cont)	2. Title Effectiveness Analysis of Ship Regular Overhaul (Cont)
References (Cont)	
<p>9. USS APACHE (ATF-67) Post Overhaul Analysis Report, Pub. 1020-01-1-1303, Oct. 1974 10. USS COCOPA (ATF-101) Post Overhaul Analysis Report, Pub. 1020-01-1-1303, Oct. 1974 11. USS QUAPAW (ATF-110) Post Overhaul Analysis Report, Pub. 1020-01-1-1303, Oct. 1974 12. Analysis of FY 1974 Regular Overhaul of USS PONCHATOUA (AO-148), Pub. 1605-01-1-1340, Nov. 1974 13. Analysis of FY 1974 Regular Overhaul of USS DELIVER (ARS-23), Pub. 1614-01-1-1337, Nov. 1974 14. Advanced Overhaul Planning for USS ABNAKI (ATF-96) and USS CHOWANOC (ATF-100), Pub. 1618-01-1-1354, Dec. 1974 15. USS GRAPPLE (ARS-7) Post-Overhaul Analysis Report, Pub. 1620-01-3-1375, April 1975 16. USS BOLSTER (ARS-38) Post Overhaul Analysis Report, Pub. 1620-01-3-1375B, August 1975</p>	

TECHNIQUE DESCRIPTION SHEET

1. Item No.	2. Title		
52	Economic Analysis of Ship Regular Overhaul		
3. Description			
<p>This technique entails post-ROH review of departure reports and related cost data, summarizing this information on the basis of SWBS/EIC, and analysis in consideration of factors such as accomplishing activity, priority and other factors. The purpose of the analysis is to identify and rank systems/equipments in terms of cost burden, and to compare estimated and actual costs. In a broader sense, an objective of the procedure is to accumulate a data bank of cost data that can be used to support more effective planning of future overhauls. The technique has been applied to a variety of overhauls involving AO, ATF, ARS, and AE types (see references). Typical results of an economic analysis of ROH are shown in the attached figure.</p>			
DESIGN	4. Type of Technique	5. Cost Parameters	6. Effectiveness Parameters
	Math Model	Life Cycle	Effectiveness
	Computer Program	Development	Perf. Capability
	Engineering Procedure X	Procurement	Availability
	Management Procedure	Installation	Reliability
	_____	Maintenance X	Maintainability
	_____	Operation	None X
	_____	Mgt./Tech Service	_____
	_____	Modification	_____
	_____	None	_____
APPLICATION	8. Type of System/Equipment	9. Life Cycle Phase	10. Functional Areas Supported
	Total Ship X	Concept Form.	ROH Planning
	Hull Structure X	Validation	ROH Cost Analysis
	Propulsion X	Development	Maintenance Manpower Analysis
	Electric Plant X	Acquisition	
	Command & Surv. X	Operation X	
	Auxiliaries X	_____	
	Outfit/Furnish. X	_____	
Armament X	_____		
11. References (ARINC Research Corporation publications unless otherwise indicated)			
1. Study of USS MISPILLION (AO-105) 1970 Regular Overhaul, Pub. 693-01-1-1075, Sept. 1970 2. Study of USS VESUVIUS (AE-15) 1970 Regular Overhaul, Pub. 696-01-1-1092, Dec. 1970 3. Study of USS COCOPA (ATF-101) 1970-71 Regular Overhaul, Pub. D02-01-1-1109, April 1971 4. Study of USS CALIENTE (AO-53) 1971 Regular Overhaul, Vol. V, Pub. D03-01-1-1115, June 1971 5. Study of USS GENESEE (AOG-8) Regular Overhaul, Pub. D05-01-1-1122, July 1971 6. Overhaul and Maintenance Planning for USS KAWISHIWI (AO-106), Pub. 1600-01-1-1269, Dec. 1973 7. Analysis of FY 1974 Regular Overhaul of USS SAFEGUARD (ARS-25), Pub. 1609-01-1-1308, July 1974 8. USS MOLALA (ATF-106) Post Overhaul Analysis Report, Pub. 1020-01-1-1303C, Oct. 1974			

Continued

TECHNIQUE DESCRIPTION SHEET

1. Item No.	2. Title
52 (Cont)	Economic Analysis of Ship Regular Overhaul (Cont)
References (Cont)	
<p>9. USS APACHE (ATF-67) Post Overhaul Analysis Report, Pub. 1020-01-1-1303, Oct. 1974 10. USS COCOPA (ATF-101) Post Overhaul Analysis Report, Pub. 1020-01-1-1303, Oct. 1974 11. USS QUAPAW (ATF-110) Post Overhaul Analysis Report, Pub. 1020-01-1-1303, Oct. 1974 12. Analysis of FY 1974 Regular Overhaul of USS PONCHATOUA (AO-148), Pub. 1605-01-1-1340, Nov. 1974 13. Analysis of FY 1974 Regular Overhaul of USS DELIVER (ARS-23), Pub. 1614-01-1-1337, Nov. 1974 14. Advanced Overhaul Planning for USS ABNAKI (ATF-96) and USS CHOWANOC (ATF-100), Pub. 1618-01-1-1354, Dec. 1974 15. USS GRAPPLE (ARS-7) Post-Overhaul Analysis Report, Pub. 1620-01-3-1375, April 1975 16. USS BOLSTER (ARS-38) Post Overhaul Analysis Report, Pub. 1620-01-3-1375B, August 1975</p>	

Continued

TECHNIQUE DESCRIPTION SHEET

1. Item No.	2. Title																																																		
52 (Cont)	Economic Analysis of Ship Regular Overhaul (Cont)																																																		
<table border="1" style="margin-left: auto; margin-right: auto;"> <caption>Data for Estimated Cost by Major System</caption> <thead> <tr> <th>System Category</th> <th>Estimated Cost (in thousands of dollars)</th> </tr> </thead> <tbody> <tr><td>Hull</td><td>~800</td></tr> <tr><td>Propulsion</td><td>~850</td></tr> <tr><td>Electrical</td><td>~220</td></tr> <tr><td>Communications and Control</td><td>~150</td></tr> <tr><td>Auxiliary Systems</td><td>~850</td></tr> <tr><td>Weapons Systems</td><td>~50</td></tr> <tr><td>Other</td><td>~320</td></tr> </tbody> </table>		System Category	Estimated Cost (in thousands of dollars)	Hull	~800	Propulsion	~850	Electrical	~220	Communications and Control	~150	Auxiliary Systems	~850	Weapons Systems	~50	Other	~320																																		
System Category	Estimated Cost (in thousands of dollars)																																																		
Hull	~800																																																		
Propulsion	~850																																																		
Electrical	~220																																																		
Communications and Control	~150																																																		
Auxiliary Systems	~850																																																		
Weapons Systems	~50																																																		
Other	~320																																																		
<table border="1" style="margin-left: auto; margin-right: auto;"> <caption>Data for Estimated Cost by Priority</caption> <thead> <tr> <th>Priority</th> <th>Estimated Cost (in thousands of dollars)</th> </tr> </thead> <tbody> <tr><td>A</td><td>~750</td></tr> <tr><td>B</td><td>~200</td></tr> <tr><td>C</td><td>~1100</td></tr> <tr><td>D</td><td>~650</td></tr> <tr><td>E</td><td>~50</td></tr> <tr><td>F</td><td>~20</td></tr> <tr><td>G</td><td>~10</td></tr> <tr><td>Unknown</td><td>~40</td></tr> </tbody> </table>		Priority	Estimated Cost (in thousands of dollars)	A	~750	B	~200	C	~1100	D	~650	E	~50	F	~20	G	~10	Unknown	~40																																
Priority	Estimated Cost (in thousands of dollars)																																																		
A	~750																																																		
B	~200																																																		
C	~1100																																																		
D	~650																																																		
E	~50																																																		
F	~20																																																		
G	~10																																																		
Unknown	~40																																																		
<table border="1" style="margin-left: auto; margin-right: auto;"> <caption>Data for Estimated Cost by Systems/Equipment</caption> <thead> <tr> <th>System/Equipment</th> <th>Estimated Cost (in thousands of dollars)</th> </tr> </thead> <tbody> <tr><td>Direct Labor</td><td>~350</td></tr> <tr><td>Contractors</td><td>~240</td></tr> <tr><td>Cargo, Stores, Laundry</td><td>~210</td></tr> <tr><td>Refueling, Subsistence</td><td>~140</td></tr> <tr><td>Ventilation</td><td>~110</td></tr> <tr><td>Storage and Dispensing Systems</td><td>~100</td></tr> <tr><td>Ship Service Equipment</td><td>~100</td></tr> <tr><td>Service Personnel</td><td>~90</td></tr> <tr><td>Fresh Water</td><td>~80</td></tr> <tr><td>Drinking and Non-Drinking Water Systems</td><td>~70</td></tr> <tr><td>Drinking Water Systems</td><td>~65</td></tr> <tr><td>Hull Protection</td><td>~60</td></tr> <tr><td>Fire Fighting, Freshwater and Salt Water Service Systems</td><td>~55</td></tr> <tr><td>Grease and Sludge</td><td>~50</td></tr> <tr><td>Power Generation</td><td>~50</td></tr> <tr><td>Hydroelectric Generating Plants</td><td>~50</td></tr> <tr><td>Deck Machinery</td><td>~50</td></tr> <tr><td>Navigation</td><td>~50</td></tr> <tr><td>Ordnance</td><td>~45</td></tr> <tr><td>Communication</td><td>~40</td></tr> <tr><td>Com. Systems</td><td>~40</td></tr> <tr><td>Electronics</td><td>~35</td></tr> <tr><td>Naval Ordnance</td><td>~30</td></tr> <tr><td>Anti-Chemical</td><td>~30</td></tr> </tbody> </table>		System/Equipment	Estimated Cost (in thousands of dollars)	Direct Labor	~350	Contractors	~240	Cargo, Stores, Laundry	~210	Refueling, Subsistence	~140	Ventilation	~110	Storage and Dispensing Systems	~100	Ship Service Equipment	~100	Service Personnel	~90	Fresh Water	~80	Drinking and Non-Drinking Water Systems	~70	Drinking Water Systems	~65	Hull Protection	~60	Fire Fighting, Freshwater and Salt Water Service Systems	~55	Grease and Sludge	~50	Power Generation	~50	Hydroelectric Generating Plants	~50	Deck Machinery	~50	Navigation	~50	Ordnance	~45	Communication	~40	Com. Systems	~40	Electronics	~35	Naval Ordnance	~30	Anti-Chemical	~30
System/Equipment	Estimated Cost (in thousands of dollars)																																																		
Direct Labor	~350																																																		
Contractors	~240																																																		
Cargo, Stores, Laundry	~210																																																		
Refueling, Subsistence	~140																																																		
Ventilation	~110																																																		
Storage and Dispensing Systems	~100																																																		
Ship Service Equipment	~100																																																		
Service Personnel	~90																																																		
Fresh Water	~80																																																		
Drinking and Non-Drinking Water Systems	~70																																																		
Drinking Water Systems	~65																																																		
Hull Protection	~60																																																		
Fire Fighting, Freshwater and Salt Water Service Systems	~55																																																		
Grease and Sludge	~50																																																		
Power Generation	~50																																																		
Hydroelectric Generating Plants	~50																																																		
Deck Machinery	~50																																																		
Navigation	~50																																																		
Ordnance	~45																																																		
Communication	~40																																																		
Com. Systems	~40																																																		
Electronics	~35																																																		
Naval Ordnance	~30																																																		
Anti-Chemical	~30																																																		
Sample Results of Analysis of Regular Overhaul Costs																																																			

TECHNIQUE DESCRIPTION SHEET

1. Item No.	2. Title				
53	EMC/EMI Instruction				
3. Description					
<p>This technique is a two-part presentation of a course of instruction to shipboard personnel on electromagnetic compatibility. The two-part presentation consists of:</p> <ul style="list-style-type: none"> a. A general description of EMI and the four types of hazard, and b. Means of detecting and reducing these factors. <p>Topics covered include electromagnetic interference (EMI), RF burn hazard, radiation hazard (RADHAZ), hazards of electromagnetic radiation to ordnance (HERO), and hazards of electromagnetic radiation to fuel (HERF).</p> <p>The course of instruction was developed for Service Force ships; however, it is potentially applicable to any type of ship.</p>					
DESIGN	4. Type of Technique		5. Cost Parameters	6. Effectiveness Parameters	7. Status
	Math Model		Life Cycle	Effectiveness	Concept
	Computer Program		Development	Perf. Capability	Technique Developed, Not Applied <input checked="" type="checkbox"/>
	Engineering Procedure		Procurement	Availability	
	Management Procedure		Installation	Reliability	
	Training Procedure <input checked="" type="checkbox"/>		Maintenance	Maintainability	
			Operation	None	Technique Applied Recurrently <input checked="" type="checkbox"/>
			Mgt/Tech Service	EMC/EMI	
			Modification		
			None	<input checked="" type="checkbox"/>	
APPLICATION	8. Type of System/ Equipment		9. Life Cycle Phase	10. Functional Areas Supported	
	Total Ship		Concept Form.	Training EMI/EMC Program	
	Hull Structure		Validation		
	Propulsion		Development		
	Electric Plant		Acquisition		
	Command & Surv. <input checked="" type="checkbox"/>		Operation	<input checked="" type="checkbox"/>	
	Auxiliaries				
	Outfit/Furnish.				
Armament					
11. References (ARINC Research Corporation publications unless otherwise indicated)					
1. EMC Instructional Program, Vol. II, Pub. 1627-01-2-1410					

TECHNIQUE DESCRIPTION SHEET

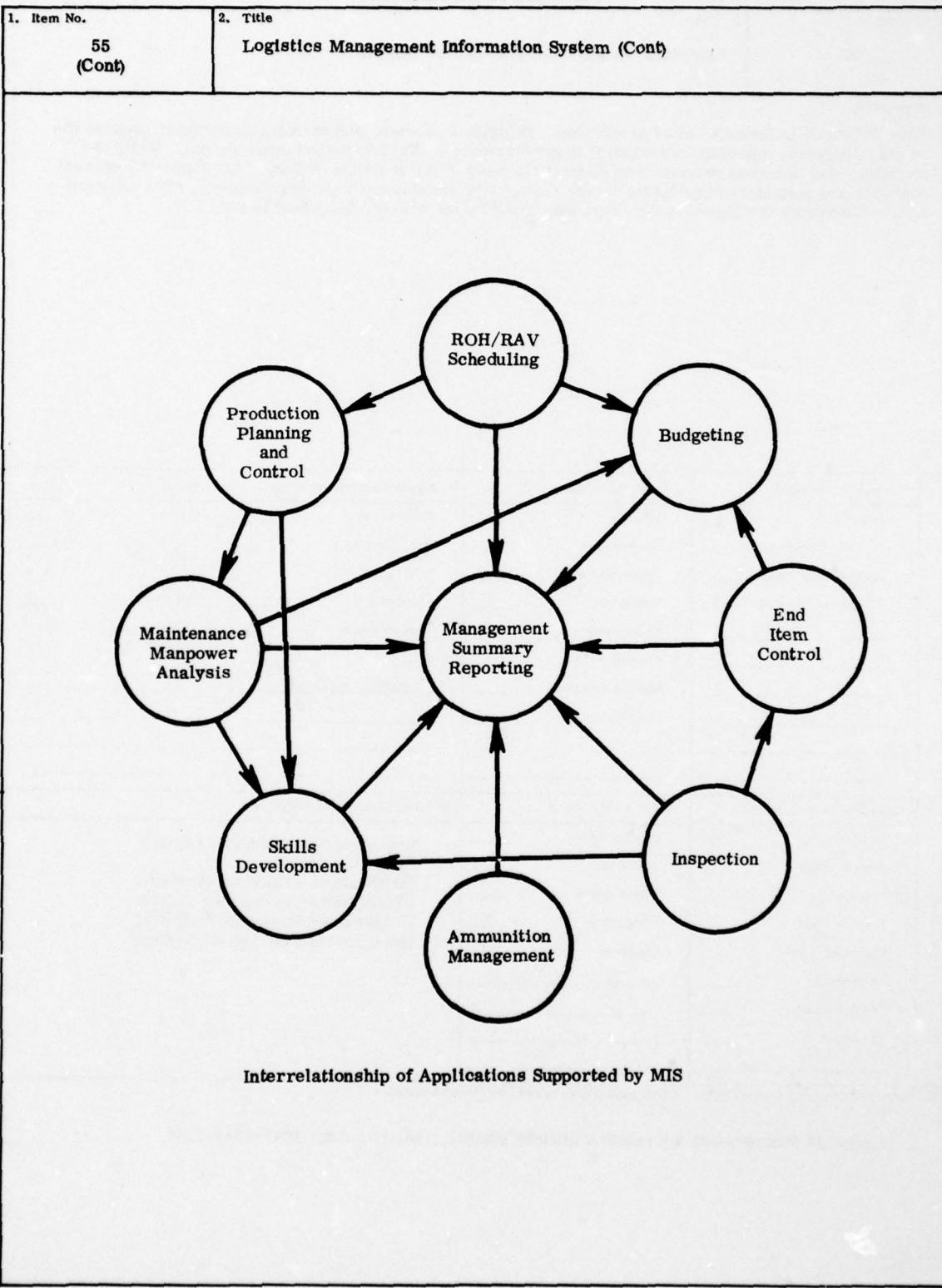
1. Item No.	2. Title			
54	EMI-Susceptibility Evaluation			
3. Description				
<p>This procedure consists of an engineering investigation of the potential effects of EMI on the operation of electronic equipment. The procedure has been applied to a shipboard gun mount (see ref. 1).</p>				
DESIGN	4. Type of Technique	5. Cost Parameters	6. Effectiveness Parameters	7. Status
	Math Model	Life Cycle	Effectiveness	Concept
	Computer Program	Development	Perf. Capability	Technique Developed,
	Engineering Procedure X	Procurement	Availability	Not Applied
	Management Procedure	Installation	Reliability	Technique Applied One Time
	_____	Maintenance	Maintainability	Technique Applied Recurrently
	_____	Operation	None	_____
	_____	Mgt/Tech Service	EMI	_____
	_____	Modification	Susceptibility X	_____
	_____	None	_____	_____
APPLICATION	8. Type of System/Equipment	9. Life Cycle Phase	10. Functional Areas Supported	
	Total Ship	Concept Form.	EMI/EMC	
	Hull Structure	Validation	_____	
	Propulsion	Development	_____	
	Electric Plant	Acquisition	_____	
	Command & Surv. P	Operation X	_____	
	Auxiliaries	_____	_____	
	Outfit/Furnish.	_____	_____	
Armament X	_____	_____		
11. References (ARINC Research Corporation publications unless otherwise indicated)				
1. Final Report on the EMI-Susceptibility Evaluation of the Mark 45 Mod 0 Gun Mount, Pub. 978-03-5-1184, July 1972				

TECHNIQUE DESCRIPTION SHEET

1. Item No.	2. Title		
55	Logistics Management Information System		
3. Description			
<p>This technique includes a set of procedures, guidelines, forms, and formats designed to provide the inputs, analyses, and outputs essential to performance of Navy logistics management. While the technique was designed primarily to support the navy of the Republic of South Viet Nam, the general concepts are considered applicable to any moderately sized naval logistics program. The attached figure illustrates the logistics functions supported by the system described in ref. 1.</p>			
DESIGN	4. Type of Technique	5. Cost Parameters	6. Effectiveness Parameters
	Math Model	Life Cycle	Effectiveness
	Computer Program	Development	Perf. Capability
	Engineering Procedure X	Procurement	Availability
	Management Procedure X	Installation	Reliability
		Maintenance	Maintainability
		Operation	None
		Mgt/Tech Service	Logistic Support X
		Modification	
		None	
APPLICATION	8. Type of System/Equipment	9. Life Cycle Phase	10. Functional Areas Supported
	Total Ship X	Concept Form.	Logistics Management Program
	Hull Structure	Validation	ROH Planning
	Propulsion	Development	Maintenance Manpower Analysis
	Electric Plant	Acquisition	Production Planning and Control
	Command & Surv.	Operation X	Maintenance Program Budgeting
	Auxiliaries		Management Information System
	Outfit/Furnish.		
	Armament		
11. References (ARINC Research Corporation publications unless otherwise indicated)			
<p>1. Logistics Management Information System Manual, Vol. III, Pub. 1607-01-1-1283</p>			

Continued

TECHNIQUE DESCRIPTION SHEET



TECHNIQUE DESCRIPTION SHEET

1. Item No.	2. Title			
56	Logistic Management Data Program			
3. Description				
<p>A Logistic Management Data Program is one designed to provide each of the several levels of program management with the information needed to make decisions concerning the ILS management function. Such a program, the CAPTOR Logistics Management Data Program (CLMDP), is described in references 1 and 2. The CLMDP includes a set of logistics data sources, an integrated data base, data analysis procedures, and a set of data products.</p>				
DESIGN	4. Type of Technique	5. Cost Parameters	6. Effectiveness Parameters	7. Status
	Math Model <input checked="" type="checkbox"/>	Life Cycle <input type="checkbox"/>	Effectiveness <input type="checkbox"/>	Concept <input type="checkbox"/>
	Computer Program <input checked="" type="checkbox"/>	Development <input type="checkbox"/>	Perf. Capability <input type="checkbox"/>	Technique Developed, Not Applied <input type="checkbox"/>
	Engineering Procedure <input type="checkbox"/>	Procurement <input type="checkbox"/>	Availability <input type="checkbox"/>	<input type="checkbox"/>
	Management Procedure <input checked="" type="checkbox"/>	Installation <input checked="" type="checkbox"/>	Reliability <input checked="" type="checkbox"/>	Technique Applied One Time <input type="checkbox"/> X
	_____	Maintenance <input checked="" type="checkbox"/>	Maintainability <input checked="" type="checkbox"/>	Technique Applied Recurrently <input type="checkbox"/>
	_____	Operation <input type="checkbox"/>	None <input type="checkbox"/>	<input type="checkbox"/>
	_____	Mgt/Tech Service <input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
	_____	Modification <input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
APPLICATION	8. Type of System/Equipment	9. Life Cycle Phase	10. Functional Areas Supported	
	Total Ship <input type="checkbox"/>	Concept Form. <input type="checkbox"/>	Logistics Management Program Logistics Management Information System	
	Hull Structure <input type="checkbox"/>	Validation <input checked="" type="checkbox"/>		
	Propulsion <input type="checkbox"/>	Development <input checked="" type="checkbox"/>		
	Electric Plant <input type="checkbox"/>	Acquisition <input checked="" type="checkbox"/>		
	Command & Surv. <input type="checkbox"/>	Operation <input checked="" type="checkbox"/>		
	Auxiliaries <input type="checkbox"/>	<input type="checkbox"/>		
	Outfit/Furnish. <input type="checkbox"/>	<input type="checkbox"/>		
Armament <input checked="" type="checkbox"/>	<input type="checkbox"/>			
11. References (ARINC Research Corporation publications unless otherwise indicated)				
1. CAPTOR Logistic Management Data Program, Pub. 1125-05-3-1299, May 1974 2. CAPTOR Logistic Management Data Program Support Contract, Pub. 1125-26-4-1313, Aug. 1974				

TECHNIQUE DESCRIPTION SHEET

1. Item No.	2. Title		
57	Equipment Procurement Specification Development		
3. Description			
<p>This technique consists of the data collection and analysis necessary to prepare equipment-level requirements, quality assurance provisions, and supplemental data in the form of procurement specifications. The procurement specifications are prepared to standard military specification format. The technique has been applied to ship armament equipment (see references), and is generally applicable to any end item.</p>			
DESIGN	4. Type of Technique	5. Cost Parameters	6. Effectiveness Parameters
	Math Model	Life Cycle	Effectiveness
	Computer Program	Development	Perf. Capability <input checked="" type="checkbox"/>
	Engineering Procedure <input checked="" type="checkbox"/>	Procurement	Availability
	Management Procedure	Installation	Reliability <input checked="" type="checkbox"/>
		Maintenance	Maintainability <input checked="" type="checkbox"/>
		Operation	None
		Mgt/Tech Service	
		Modification	
APPLICATION	None	<input checked="" type="checkbox"/>	
	8. Type of System/Equipment	9. Life Cycle Phase	10. Functional Areas Supported
	Total Ship	Concept Form.	Procurement Specification Development
	Hull Structure	Validation	
	Propulsion <input checked="" type="checkbox"/>	Development	
	Electric Plant <input checked="" type="checkbox"/>	Acquisition <input checked="" type="checkbox"/>	
	Command & Surv. <input checked="" type="checkbox"/>	Operation	
	Auxiliaries <input checked="" type="checkbox"/>		
Outfit/Furnish.			
Armament <input checked="" type="checkbox"/>			
11. References (ARINC Research Corporation publications unless otherwise indicated)			
<ol style="list-style-type: none"> 1. NOSC Procurement Specification for Dummy Director MK 10, Mod 0, Pub. 1621-04-3-1366, March 1975 2. NOSC Procurement Specification for Remote Optical Director EX 35 Mod 1, Pub. 1625-01-1-1430, Aug. 1975 3. NOSC Procurement Specification for 30 MM Machine Gun Mount EX 74 Mod 1, Pub. 1625-01-1-1431, Aug. 1975 4. NOSC Procurement Specification for Radar Gun Fire Control System EX 93 Mod 1, Pub. 1625-01-1-1432, Aug. 1975 			

TECHNIQUE DESCRIPTION SHEET

1. Item No.	2. Title					
58	Conduct of Shipboard Habitability Survey					
3. Description						
<p>A procedure and associated set of 31 checklists for conducting a habitability survey of an AO-22 class ship was developed and applied. The checklists, while unique to AO-22 class ships, can be easily refined for applicability to other ship types. The purpose of the procedure is to determine habitability deficiencies relative to existing standards. Figure 1 is a sample of the habitability survey checklist. Figure 2 lists the complete set of checklists, and illustrates the type of shipboard spaces to which the checklists apply.</p>						
DESIGN	4. Type of Technique		5. Cost Parameters	6. Effectiveness Parameters	7. Status	
	Math Model	—	Life Cycle	Effectiveness	Concept	
	Computer Program	—	Development	Perf. Capability	Technique Developed, Not Applied	
	Engineering Procedure	X	Procurement	Availability		
	Management Procedure	—	Installation	Reliability	Technique Applied One Time	
		—	Maintenance	Maintainability		
		—	Operation	None	Technique Applied Recurrently	
		—	Mgt/Tech Service	Habitability	X	
		—	Modification			
		—	None	X		
APPLICATION	8. Type of System/Equipment		9. Life Cycle Phase	10. Functional Areas Supported		
	Total Ship	X	Concept Form.	Habitability of Ships Material Condition Assessment		
	Hull Structure	—	Validation			
	Propulsion	—	Development			
	Electric Plant	—	Acquisition			
	Command & Surv.	—	Operation			X
	Auxiliaries	—				
	Outfit/Furnish.	—				
Armament	—					
11. References (ARINC Research Corporation publications unless otherwise indicated)						
<ol style="list-style-type: none"> 1. COMSERVPAC Habitability Improvement Program, COMSERVPACINST 9330.1, 25 Apr 1973 2. Procedure for Conducting Habitability Surveys of Existing Ships, Vol. II, Pub. D03-01-1-1115, June 1971 						

Continued

TECHNIQUE DESCRIPTION SHEET

1. Item No.	2. Title						
58 (Cont)	Conduct of Shipboard Habitability Survey (Cont)						
HABITABILITY SURVEY							
Ship _____				Checklist No. _____ 9			
Space _____				Title <u>Living Spaces, Crew's Berthing</u>			
Item No.	Standard	Source of Standard		Does Ship Comply With Standard		Remarks	
		Doc.	Paragraph	Yes	No		
9-1	Gross area (total area less area of large ventilation and access trunks) should be in accordance with the following:	1 2	II 2.b.(2) 5.b.(1)(a)				
	Ship Length (ft) Gross Area (sq ft)						
	Less than 300 ft 16						
	Over 300 ft 18						
9-2	Net area (deck area that can actually be walked on) should be in accordance with the following:	1 2	II 2.b.(2) 5.b.(1)(a)				
	Ship Length (ft) Net Area (sq ft)						
	Less than 300 ft 6						
	Over 300 ft 7						
9-3	Berths should be installed in fore and aft position.	1	II 2.c.(1)				
9-4	Tiers should not be more than 3 high.	1 2	II 2.c.(1) 5.b.(3)(a)				
9-5	Berths should be of the type shown in Dwg 805-1409485 with 3-in. mattresses (locker-under-bunk type).	1	II 2.c.(1)				
9-6	The clear vertical distance above mattresses should be not less than 18 inches on ships under 300 ft; not less than 20 inches on ships over 300 ft. Bottom of lower berth mattress should be at least 6 inches above the deck.	1 2	II 2.c.(3) 5.b.(3)(a)				
9-7	Adjacent tiers separated by a privacy divider from 7 in. above deck to 21 in. above frame of top berth (per NAVSHIPS Dwg 805-1646044). Divider extends from frame at head of berth to minimum of 36 in. Partitions at end should be in accordance with Dwg 805-2214469.	1 2	II 2.c.(4) 5.b.(3)(a)				
9-8	In living spaces located adjacent to noisy spaces, berths should be located as remotely as possible from noise source.	1	II 2.c.(5)				
9-9	Access should provide for free movement of men within space, with a minimum of men passing berth.	1	II 2.d.(1)				
9-10	Where practicable, crew berths should not be installed more than 2 tiers in tandem without a 24 in. athwartship passage at one end (not applicable for berths at longitudinal boundaries of space).	1 2	II 2.d.(1) 5.b.(3)(a)				
9-11	Access to berths from main passage should be avoided where possible. Lockers or partial lightweight joinder partitions should be used to shield berthed men from traffic.	1 2	II 2.d.(2) 5.b.(3)(a)				
9-12	Berths should be located as far from access ladders as possible. Recreation facilities should be located near access and lockers and partitions used as means of separation between recreation areas and berths.	1	II 2.d.(3)				

Sheet 1 of 2

Figure 1. Sample of Habitability Survey Checklist

Continued

TECHNIQUE DESCRIPTION SHEET

Figure 2. Matrix of Available Checklists for Habitability Survey

TECHNIQUE DESCRIPTION SHEET

1. Item No.	2. Title			
59	Development of Habitability Improvement Plans for Ships/Classes			
3. Description				
<p>A procedure for developing class/ship Habitability Improvement Plans was developed and applied. The procedure consists of identifying a set of improvement projects based on conduct of a habitability survey (see item 58), and compiling descriptive, priority, schedule, responsibility and interface data using the format illustrated in the attached figure. The procedure, which has been applied to an AO-22 class ship, is applicable to any type of ship.</p>				
DESIGN	4. Type of Technique	5. Cost Parameters	6. Effectiveness Parameters	7. Status
	Math Model	Life Cycle	Effectiveness	Concept
	Computer Program	Development	Perf. Capability	Technique Developed, Not Applied
	Engineering Procedure	Procurement	Availability	
	Management Procedure X	<i>Installation</i>	Reliability	Technique Applied One Time X
		Maintenance	Maintainability	Technique Applied Recurrently
		Operation	None	
		Mgt/Tech Service	Habitability X	
		Modification		
		None		
APPLICATION	8. Type of System/Equipment	9. Life Cycle Phase	10. Functional Areas Supported	
	Total Ship X	Concept Form.	Habitability of Ships	
	Hull Structure	Validation	ROH Planning	
	Propulsion	Development	ROH Work Package Development	
	Electric Plant	Acquisition		
	Command & Surv.	Operation X		
	Auxiliaries			
	Outfit/Furnish.			
	Armament			
	AO-22 X			
11. References (ARINC Research Corporation publications unless otherwise indicated)				
<ol style="list-style-type: none"> 1. Habitability Improvement Plan for Pacific Fleet AO-22 Class Ships, Vol. III, Pub. D03-01-1-1115, June 1971 2. Habitability Improvement Plan for USS CALIENTE (AO-53), Vol. IV, Pub. D03-01-1-1115, June 1971 				

Continued

TECHNIQUE DESCRIPTION SHEET

1. Item No. 59 (Cont)	2. Title Development of Habitability Improvement Plans for Ships/Classes (Cont)																								
HABITABILITY IMPROVEMENT ITEM																									
<table border="1" style="width: 100%; border-collapse: collapse;"> <tr> <td colspan="6" style="padding: 5px;">1. Habitability Item Number and Title</td> <td style="width: 15%;">2. Applicable Class/Ship</td> <td style="width: 15%;">3. Priority</td> </tr> <tr> <td colspan="9" style="height: 100px;"></td> </tr> </table>									1. Habitability Item Number and Title						2. Applicable Class/Ship	3. Priority									
1. Habitability Item Number and Title						2. Applicable Class/Ship	3. Priority																		
4. Accomplishing Activity			5. When to Accomplish			6. Estimates																			
Ship Force	Tender	Shipyard	Any Upkeep	ROH	Rehab	Prod. (M-D)	Prod. (\$)	Design Services	Material	Total Cost															
7. Interfaces/Constraints						8. References			9. Applicable Spaces																
10. Description																									

Format for Compiling Data for Habitability Improvement Program

TECHNIQUE DESCRIPTION SHEET

1. Item No.	2. Title			
60	Determination of Spare Parts Inventory for Weapon System			
3. Description				
<p>This technique consists of the calculation of spare parts requirements for a given shipboard weapon system, based on a given maintenance scenario. The technique is based on calculation of spare parts requirements in terms of either usage or failure rates, as appropriate. The technique was applied in calculation of a 2-year spares inventory requirement for a fleet of coastal patrol and interdiction craft (see ref. 1).</p>				
DESIGN	4. Type of Technique	5. Cost Parameters	6. Effectiveness Parameters	7. Status
	Math Model <input checked="" type="checkbox"/>	Life Cycle <input type="checkbox"/>	Effectiveness <input type="checkbox"/>	Concept <input type="checkbox"/>
	Computer Program <input checked="" type="checkbox"/>	Development <input type="checkbox"/>	Perf. Capability <input type="checkbox"/>	Technique Developed, Not Applied <input type="checkbox"/>
	Engineering Procedure <input type="checkbox"/>	Procurement <input type="checkbox"/>	Availability <input type="checkbox"/>	
	Management Procedure <input type="checkbox"/>	Installation <input type="checkbox"/>	Reliability <input checked="" type="checkbox"/>	Technique Applied One Time <input checked="" type="checkbox"/>
	<input type="checkbox"/>	Maintenance <input checked="" type="checkbox"/>	Maintainability <input type="checkbox"/>	Technique Applied Recurrently <input type="checkbox"/>
	<input type="checkbox"/>	Operation <input type="checkbox"/>	None <input type="checkbox"/>	
	<input type="checkbox"/>	Mgt/Tech Service <input type="checkbox"/>		
	<input type="checkbox"/>	Modification <input type="checkbox"/>		
<input type="checkbox"/>	None <input type="checkbox"/>			
APPLICATION	8. Type of System/Equipment	9. Life Cycle Phase	10. Functional Areas Supported	
	Total Ship <input type="checkbox"/>	Concept Form. <input type="checkbox"/>	Spares Inventory Determination	
	Hull Structure <input type="checkbox"/>	Validation <input type="checkbox"/>		
	Propulsion <input type="checkbox"/>	Development <input type="checkbox"/>		
	Electric Plant <input type="checkbox"/>	Acquisition <input checked="" type="checkbox"/>		
	Command & Surv. <input type="checkbox"/>	Operation <input checked="" type="checkbox"/>		
	Auxiliaries <input type="checkbox"/>	<input type="checkbox"/>		
	Outfit/Furnish. <input type="checkbox"/>	<input type="checkbox"/>		
Armament <input checked="" type="checkbox"/>	<input type="checkbox"/>			
11. References (ARINC Research Corporation publications unless otherwise indicated)				
<p>1. Spare Parts Inventory Listing, Pub. 1625-01-2-1390, June 1975.</p>				

TECHNIQUE DESCRIPTION SHEET

1. Item No.	2. Title			
61	Logistic Support Planning for Ship Class			
3. Description				
<p>This technique entails the development of a Logistic Support Plan (LSP) for a small ship class. The plan describes the actions that must be taken by appropriate authorities during the ship acquisition phase to ensure that all ships of the class are properly supported in all logistic areas after delivery. Ref. 1 illustrates an LSP developed for the T-ATF 166 class.</p>				
DESIGN	4. Type of Technique	5. Cost Parameters	6. Effectiveness Parameters	7. Status
	Math Model	Life Cycle	Effectiveness	Concept
	Computer Program	Development	Perf. Capability	Technique Developed, Not Applied
	Engineering Procedure	Procurement	Availability	
	Management Procedure X	Installation	Reliability	Technique Applied One Time X
		Maintenance	Maintainability	Technique Applied Recurrently
		Operation	None	
		Mgt/Tech Service	Logistics X	
		Modification		
		None		
APPLICATION	8. Type of System/Equipment	9. Life Cycle Phase	10. Functional Areas Supported	
	Total Ship X	Concept Form.	Logistic Support Planning	
	Hull Structure	Validation		
	Propulsion	Development		
	Electric Plant	Acquisition X		
	Command & Surv.	Operation		
	Auxiliaries			
	Outfit/Furnish.			
Armament				
11. References (ARINC Research Corporation publications unless otherwise indicated)				
1. T-ATF 166 Class Logistic Support Plan, Pub. 1092-01-1-1359, Jan. 1975				

TECHNIQUE DESCRIPTION SHEET

1. Item No.	2. Title			
62	Specific Operational Requirement Review			
3. Description				
<p>This technique consists of the review of a Specific Operational Requirements (SOR) document. Ref. 1 illustrates this technique for a shipboard gun system.</p>				
DESIGN	4. Type of Technique	5. Cost Parameters	6. Effectiveness Parameters	7. Status
	Math Model	Life Cycle	Effectiveness	Concept
	Computer Program	Development	Perf. Capability	Technique Developed, Not Applied
	Engineering Procedure	Procurement	Availability	
	Management Procedure X	Installation	Reliability	Technique Applied One Time X
		Maintenance	Maintainability	
		Operation	None	Technique Applied Recurrently
		Mgt/Tech Service		
		Modification		
		None	X	
APPLICATION	8. Type of System/Equipment	9. Life Cycle Phase	10. Functional Areas Supported	
	Total Ship	Concept Form.	Specific Operational Requirements	
	Hull Structure	Validation		
	Propulsion	Development X		
	Electric Plant	Acquisition		
	Command & Surv.	Operation		
	Auxiliaries			
	Outfit/Furnish.			
Armament X				
11. References (ARINC Research Corporation publications unless otherwise indicated)				
1. Review and Critique of Draft SOR 12-04R3 for the 5"/54 Caliber Mark 45 Mod 0 Gun Mount, Pub. 978-20-9-1260, July 1973				

TECHNIQUE DESCRIPTION SHEET

1. Item No.	2. Title			
63	Analysis of Relationships Between Mission Requirements and ROH Cycle			
3. Description				
<p>This technique involves the analysis of a ship's ability to perform a variety of mission categories (ASW, AAW, etc.) based on a number of significant variables such as equipment reliability and maintainability cruise duration, etc. The technique consists of a simulation model based on generic inputs and outputs. A preliminary model has been developed (see reference 1).</p>				
DESIGN	4. Type of Technique	5. Cost Parameters	6. Effectiveness Parameters	7. Status
	Math Model <input checked="" type="checkbox"/>	Life Cycle <input type="checkbox"/>	Effectiveness <input type="checkbox"/>	Concept <input checked="" type="checkbox"/>
	Computer Program <input type="checkbox"/>	Development <input type="checkbox"/>	Perf. Capability <input type="checkbox"/>	Technique Developed, Not Applied <input type="checkbox"/>
	Engineering Procedure <input type="checkbox"/>	Procurement <input type="checkbox"/>	Availability <input checked="" type="checkbox"/>	Technique Applied One Time <input type="checkbox"/>
	Management Procedure <input type="checkbox"/>	Installation <input type="checkbox"/>	Reliability <input checked="" type="checkbox"/>	Technique Applied Recurrently <input type="checkbox"/>
	<input type="checkbox"/>	Maintenance <input type="checkbox"/>	Maintainability <input checked="" type="checkbox"/>	<input type="checkbox"/>
	<input type="checkbox"/>	Operation <input type="checkbox"/>	None <input type="checkbox"/>	<input type="checkbox"/>
	<input type="checkbox"/>	Mgt/Tech Service <input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
	<input type="checkbox"/>	Modification <input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
	<input type="checkbox"/>	None <input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
APPLICATION	8. Type of System/Equipment	9. Life Cycle Phase	10. Functional Areas Supported	
	Total Ship <input checked="" type="checkbox"/>	Concept Form. <input type="checkbox"/>	EOC Maintenance Management Maintenance Strategy Planning	
	Hull Structure <input type="checkbox"/>	Validation <input type="checkbox"/>	<input type="checkbox"/>	
	Propulsion <input checked="" type="checkbox"/>	Development <input type="checkbox"/>	<input type="checkbox"/>	
	Electric Plant <input checked="" type="checkbox"/>	Acquisition <input type="checkbox"/>	<input type="checkbox"/>	
	Command & Surv. <input checked="" type="checkbox"/>	Operation <input checked="" type="checkbox"/>	<input type="checkbox"/>	
	Auxiliaries <input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
	Outfit/Furnish. <input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
Armament <input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>		
11. References (ARINC Research Corporation publications unless otherwise indicated)				
<p>1. Development of a Preliminary Simulation Model for Relating Mission Requirements to ROH Cycle, Letter Report #1 to Contract N00140-73-D-0074, June 1973</p>				

INDEX

(By Technique Description Sheet Item Number)

Configuration Management, 1, 2, 3, 4, 5, 6

Criticality Ranking, 26, 39

Cost Analysis

Life Cycle, 33, 44

Maintenance, 14, 33, 34, 35

Regular Overhaul, 52

Design Analysis

Electrical, 20, 26

Structural, 17

Electrical Design Analysis, 20

Electromagnetic Interference/Electromagnetic Compatibility, 53, 54

Electronic Test Equipment, 4

Engineering Analysis

Maintenance

Cost Analysis of Ship Equipment Maintenance, 28

Engineering Change Proposal Evaluation, 6

Extended Operating Cycle Systems Analysis, 38, 63

Fault Isolation Procedure Analysis, 20

Figure of Merit Determination, 11

LO-MIX Maintenance Engineering Analysis, 24

Maintainability Assessment of Systems/Equipments, 27

Parts Data Bank Establishment, 13

Planned Maintenance Subsystem Effectiveness, 31

Shipboard Mechanical Problem Identification, 15

Technical Repair Standard Preparation, 39

Reliability, 11, 13, 15, 28

Extended Operating Cycle, 30, 36, 37, 38, 39

Failure Analysis, 16, 18, 19

Fleet Modernization Program, 3, 5

Light-Off Examination, 42, 43

Logistics

- Management Information System, 55, 56**
- Management Program, 55, 56**
- Logistic Support Planning, 61**

Management

- Configuration, 1, 2, 3, 4, 5, 6**
- EOC Maintenance, 30, 36, 37, 38, 39**
- Logistic, 55, 56**
- SFOMS, 38, 39, 50**

Maintainability

- Demonstration, 22, 23**
- Measurement**
 - Cost Analysis of Ship Equipment Maintenance, 28**
 - Critical Equipment List Development, 39**
 - Equipment Behavior Measure Development, 30**
 - Figure of Merit Determination, 11, 14**
 - Maintainability Assessment of Systems/Equipments, 27**
 - Maintenance History Analysis, 25**
 - Maintenance Resource Consumption Analysis, 26**
 - R&M Indices for Ship Equipments, 29**
 - Prediction, 11, 21, 27, 28, 38**
 - Trend Analysis, 25, 30**

Maintenance

- Budgeting, 35, 55**
- Cost Analysis, 14, 33, 34, 35**
- Engineering Analysis (See "Engineering Analysis, Maintenance")**
- Manpower Analysis, 52, 55**
- Strategy Planning, 35, 36, 63**

Material Condition Assessment, 32, 47, 58

Planned Maintenance Subsystem (PMS), 4, 31

Planning

- Maintenance Strategy, 35, 36**
- Regular Overhaul**
 - Baseline Repair Profile Development, 40**
 - Configuration Management Analysis, 3**

- Critical Equipment List Development, 39
- Development of LOE Preparation Plan, 42
- Estimating Ship's Force ROH Work, 50
- Extended Operating Cycle Systems Analysis, 38, 63
- Habitability Improvement Plan Development, 59
- Logistics Management Information System, 55
- Pre-Overhaul Training of Ship Personnel, 44
- Regular Overhaul Advance Planning, 46
- Regular Overhaul Economic Analysis, 52
- Regular Overhaul Effectiveness Analysis, 51
- Shipalt Status/Applicability Evaluation, 5
- Shipcheck Planning, 45
- Standardized Work Request Development, 48
- Technical Repair Standard Preparation, 41

- Pre-Overhaul Test & Inspection (POT&I), 45, 47
- Procurement Specification Development, 57
- Production Planning and Control, 55

- Regular Overhaul
 - Cost Analysis, 52
 - Effectiveness Analysis, 51
 - Planning (See "Planning, Regular Overhaul")
 - Work Package Development, 38, 40, 47, 48

- Reliability
 - Demonstration, 9, 10
 - Engineering Analysis, 11, 13, 15, 28
- Measurement
 - Cost Analysis of Ship Equipment Maintenance, 28
 - Critical Equipment List Development, 39
 - Equipment Behavior Measure Development, 30
 - Figure of Merit Determination, 11, 14
 - Maintenance History Analysis, 25
 - Maintenance Resource Consumption Analysis, 26
 - Reliability Assessment of Ship Systems, 16
 - R&M Indices for Ship Equipments, 29

Prediction, 7, 8, 10, 16, 28, 39
Program Evaluation, 12, 13
Trend Analysis, 25, 30

Ship's Force Overhaul Management System, 38, 49, 50

Spares Inventory Determination, 60

Specific Operational Requirement Review, 62

Structural Design Analysis, 17

Testing

- Failure Analysis by Lab Testing**, 19
- Maintainability Assessment**, 27
- Maintainability Demonstration Test Planning**, 22
- Maintainability Demonstration Testing**, 23
- Reliability Assessment**, 16
- Reliability Demonstration Test Planning**, 9
- Reliability Demonstration Testing**, 10

Training, 43, 44, 53